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JUNGLE MEMORIES

BY

Lt.-Col. E. G. Phythian-Adams, O.B.E., F.Z.S., I.A. (Retired).

Part IX—Antelope and Deer

(*With two plates*)

(*Continued from p. 607 of Volume 49*)

BLACKBUCK

'The Black-buck' says Aflalo in *The Sportsman's Book for India*, 'deserves the premier place both from his numbers and his ubiquity, and we might add, his beauty. He is a never ending source of interest and excitement to the subaltern, and the pursuit of him supplies a perennial and perfectly excellent school for the exercise of his ingenuity, patience and marksmanship.' To which one might also add that this form of shikar never seems to pall, and though I seldom fire a rifle nowadays I find that the sight of a good head impels me to do my best to outwit him. But I must confess that my memories of this elusive animal are as hard to recapture as it is to bring him to bag, largely I suppose owing to the fact that they are (or at any rate used to be) so common, and that one's recollections are therefore less vivid as compared with the pursuit of nobler game. Not that I would for a moment depreciate the Blackbuck, for a really fine head makes a grand trophy and the difficulty of securing it adds to its value. Still, the fact remains that it is hard to remember details of individual stalks, for my diaries are concerned more with regular shikar trips than with outings of a day or two. However, as is only natural, I do remember my first buck which was bagged near Kamptee so far back as 1906. A good friend on the Railway used to take me and another subaltern down the line in his trolley when he was on inspection duty, for any chances of shikar which might offer. On one of these occasions we sighted a herd with a good head some 600 yards away, and as it was my turn for a shot I went after it. A convenient nullah afforded a good line of approach so I slipped off while the trolley continued its course to divert the attention of the buck. The nullah though winding gave good cover, and a final crawl over the open to some convenient bushes brought me within easy shot. The head was only 19½ inches, nothing to be compared with those obtainable in Central India, but it was my first and was prized accordingly.

Having broken the ice I managed to secure several more heads on subsequent occasions but buck were not common in that part, and it was not till I marched with my regiment some months later from Kamptee to Poona, a matter of some 450 miles, that I met them in any numbers. While we were passing through the Berars they were so plentiful that seldom a day elapsed without my bagging one or more for the officer's mess and for the men. But even venison palls, and I remember that my C.O. at last told me as Mess Secretary that a change of diet would be appreciated. As it happened I had shot a nice young buck that morning and when it appeared at dinner that night suitably disguised, all admitted that the *mutton* chops were the best they had ever tasted! What grand days those were. Everything was so well organised that it went like clockwork. The Mess tent was struck after dinner and sent on overnight to the next camping ground, accompanied part of the way by the coffee-shop for officers and men. *Reveillee* sounded at dawn and within an hour all the remaining tents had been struck and packed, and the regiment paraded ready to march off. I, as acting Quartermaster, had to ride on ahead to mark out the new camp and to check over the supplies provided by the civil authorities. The marches averaged 13 miles, though I remember one of only 4 when the whole regiment had to turn on to getting the carts through the deep sand of the Godavari river. That day I certainly had my hands full, but generally I had ample time to do a little scouting within a few miles of camp before the regiment arrived, with a view to shikar in the afternoon. We were, I believe, the first to march that way for upwards of 100 years and any amount of small game was available besides buck. I remember that one day the Deputy Commissioner camped alongside us. He told me that not long before while stalking a buck he had come across a party of no less than five cheetahs engaged in the same quest. I do not suppose there are any hunting leopards left in those parts now, and indeed it is doubtful whether they are to be found in a wild state anywhere in India.

My best memory is of an enormous herd of buck numbering many hundreds near Basim. With some difficulty, owing to the number of watchful eyes, I had managed to work up to a good buck, but when I fired he bolted 50 yards into a small patch of scrub from which I saw him emerge on the far side and gallop off evidently untouched. Rather disgruntled, and finding little consolation in the old saying that all hits are history and all misses mystery, I was starting back for camp when a villager working not far away called out to enquire whether I did not want the buck I had shot. Investigation showed the original animal lying dead in the bushes, shot through the heart. As he fell at the end of his final spurt he must have put up another whose departure I had viewed with such mixed feelings. All of which shows as the monkey said, that things are not always what they seem! The number of buck all over the Berars in those days was incredible, but a friend who came the same way only 15 years later told me that in the meantime they had been practically exterminated in most parts, owing to lack of control over the issue of weapon permits and the absence of any official effort to preserve wild life. I have never seen an albino buck outside a zoo, but when passing through Ahmednagar on that march I heard of a well-known one said to be with a particoloured herd—however I had no time to go after it. Round a large military station like Poona buck were naturally scarce, but even so they were obtainable near Lonikhand not many miles out along the Sirur road. My best heads, which I still have, were obtained at Yewat some way down the line. I had a very pleasant Christmas camp there in 1910 with my shikari Diwaji and enjoyed some excellent small game shooting as well. The next blackbuck I shot was at the foot of the northern slopes of the Nilgiris many years later after I had retired, but the heads there are poor, and in fact the whole animal is noticeably smaller than those in the Deccan and further north. My last was shot in the Bellary district while on tour during the recent war. There are still a fair number there as also in certain parts of Mysore State.

Blackbuck horns are measured straight (and not following the curves as with a deer's antlers) and it takes a good deal of practice to judge whether a head is a good one or not. If it seems disproportionately larger to the size of the animal than it certainly is, but any may be considered shootable whose colouration is notably black and white. In the South a 20-incher is definitely good. The handsomest trophies are those heads with the tips of the horns wide enough apart to form an equilateral triangle. Blackbuck are generally found on cultivated land, and it is well to remember that a bullet from a high velocity rifle carries a very very long way, and may find a billet in some unfortunate villager far beyond. A story was current many years ago of a sportsman who had in this way killed a man, and the shikari suggested concealing the body down a well, assuring his master that no one else had seen the accident. Whereupon the sportsman promptly shot the shikari also and then disposed of both bodies. A very old chestnut, but so antique that it may bear repeating. When after buck it is as well to take a local man with you as he will know not only where they are to be found at different hours of the day, but also where his fellow villagers are likely to be working. Even so it is desirable to use the slope of the ground so far as possible to act as a stop butt to the bullet. There is only one sporting way of bringing a buck to bag, and that is by a fair stalk. Shooting them from a car or from a bullock cart is sheer laziness and definitely not sport. One can learn a lot too when stalking, for even in broken country it is far from easy to get within the close range which is always so desirable in any form of shikar. Blackbuck meat, it may be added, is excellent.

CHINKARA

My experience with these sporting little gazelles is limited, as they are far scarcer than buck, at any rate in the Deccan and South India. My first was one of those lucky chances which befall all shikaris at times, in fact it was a lucky day altogether. For it was on the way back, after shooting my first tiger that I suddenly spotted a chinkara staring at us in the light scrub jungle not 40 yards away. As the tonga passed a good-sized bush I jumped out and from its cover got an easy shot. The bullet caught the chink on the point of the shoulder and apparently exploded there—it was a .400 Jeffery softnose with a lot of lead showing. A patch of skin the size of a small plate had completely disappeared, and no part of the bullet appeared to have penetrated, but the animal was knocked over stone dead. I have had an exactly similar experience with a barking deer.

I do not remember shooting more than one or two chinkara on the march from Kamptee, owing no doubt to the country being more suited to blackbuck, but after arrival at Poona I soon discovered that they were not uncommon in the vicinity of Lonikhand hill, and often went after them at week-ends. I found them far more difficult to bring to bag than buck, though one would expect the converse to be the case, as the broken ground they inhabit seems to offer such easy means of approach. But the chinkara is extremely wideawake, and often when I have reached a spot from which a close shot should have been certain, I found that the herd had moved and was still out of range. Since those days the only chinkara I have seen were in Las Bela while I was after oorial. I did not go after them seriously and so never got one, a fact which I now regret as I believe they are the Persian variety of gazelle. A few are said to exist in Mysore State and in North Coimbatore, but I have never come across them. I still have two mounted heads to remind me of the Poona days, and handsome little trophies they are.

NILGAI

These fine antelope carry such miserable heads that few sportsmen care to shoot them, except to assist the villagers in protecting their crops. The only one I have bagged was in Raipur in 1910, a good head as they go, but the best part of the trophy was his splendid iron-grey skin which made a very handsome rug for the floor. In later years I came across them on several occasions in Hyderabad State but never cared to fire at another, as the meat is generally wasted owing to the quite erroneous belief that they are in some way connected with the cow and that their flesh is therefore taboo. In the Nilgiris 25 years ago there was a solitary bull near Kullar at the foot of the Mettupalaiyam ghat, and at my suggestion the Nilgiri Game Assciation afforded him and his kin full protection. But no doubt he has passed on long ago, and I have never heard of any others in the district, though the broken country beyond Anaikatti at the foot of the northern slopes would seem ideal for them, and there are said to be a few in the Talaimalai forest just across the Mysore Ditch which forms the boundary between the Nilgiris and Mysore.

FOUR-HORNED ANTELOPE

My memories of this sporting little animal, so far as earlier days are concerned are rather vague. I know that I shot a number in the Central Provinces, generally in the course of chance beats for anything which might turn up, but I have only a single skull to

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SÁLIM ALI, S. B. SETNA, H. SANTAPAU

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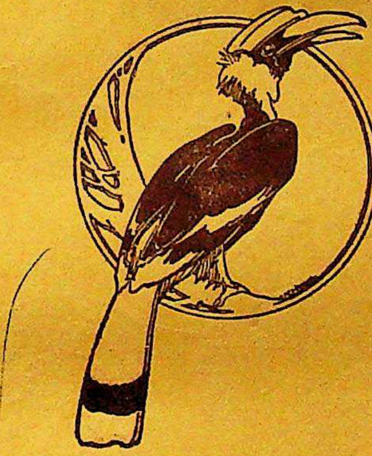

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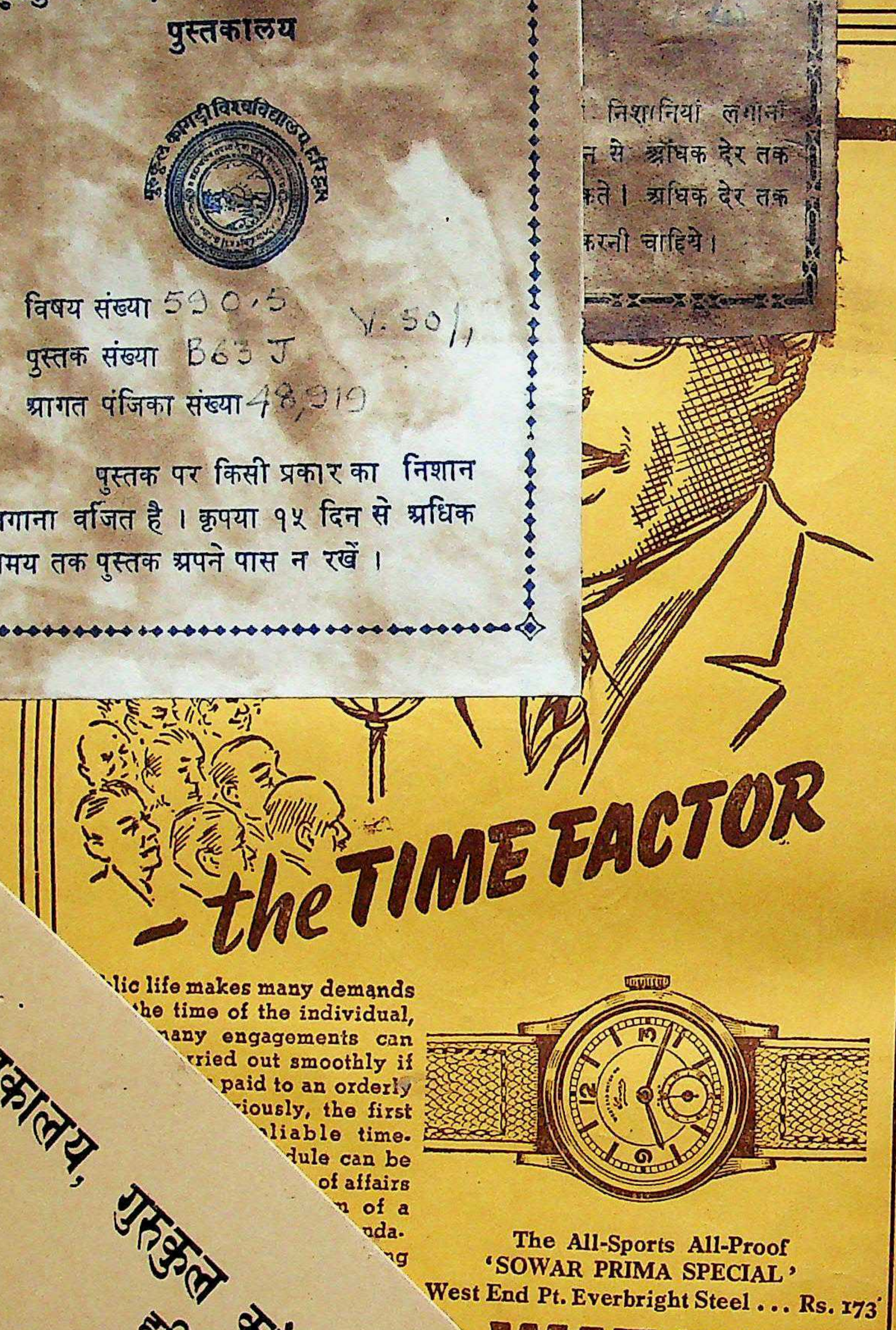

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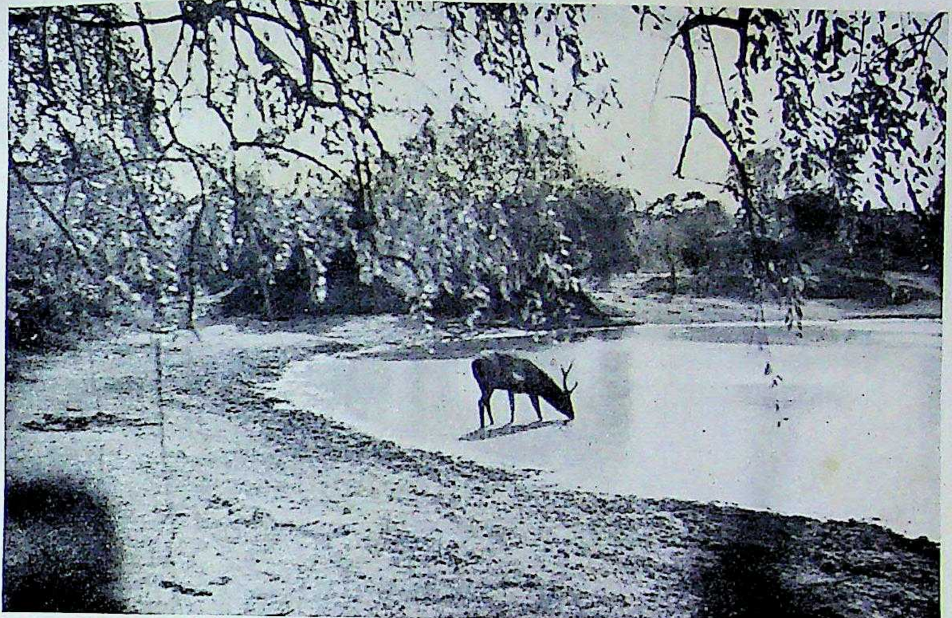
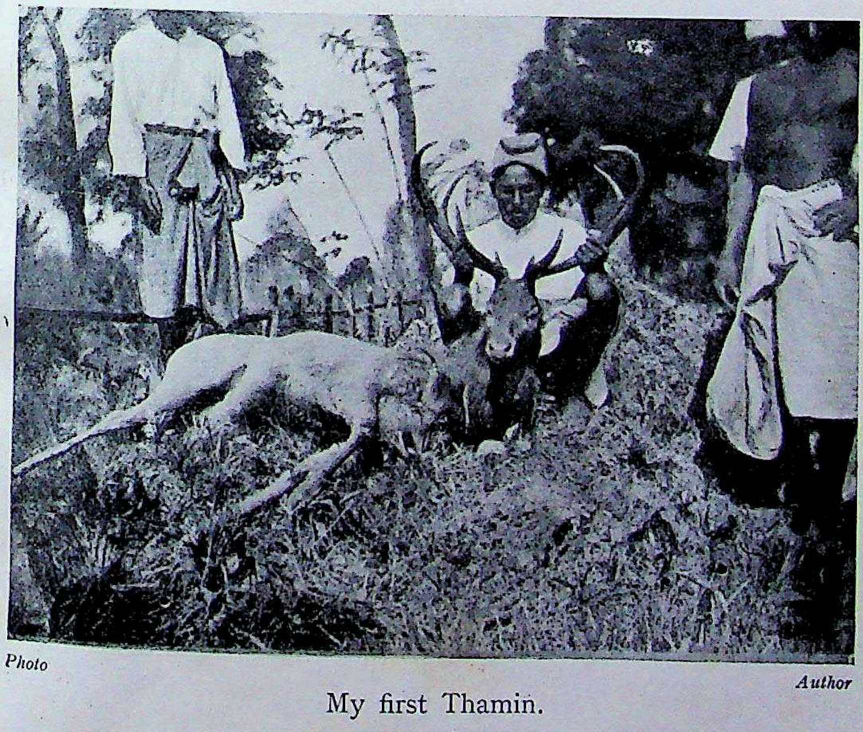


Photo *Col. H. G. Rossel*

Sambar.



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My first Thamin.

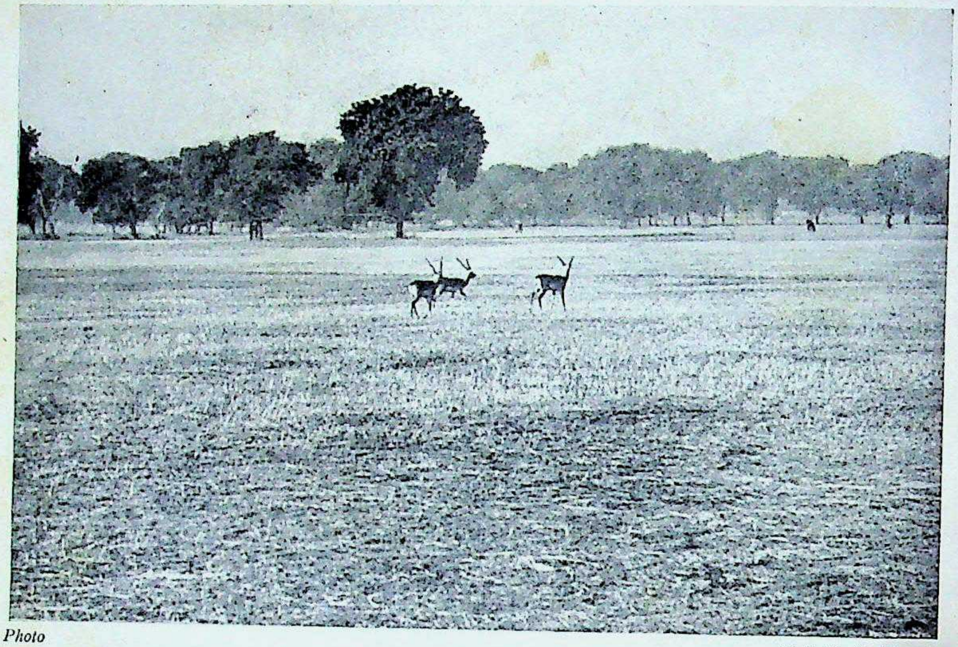

Photo *Col. H. G. Rossel*

Blackbuck.

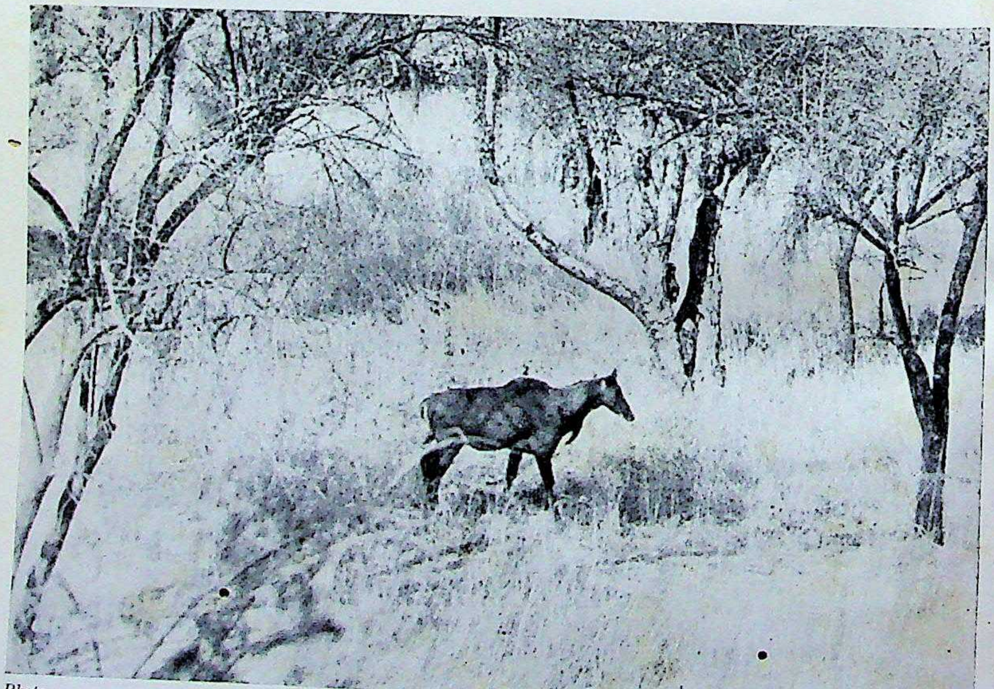

Photo *H. H. The Maharao of Kotah*

Bull Nilgai.

remind me of those days. One occasion however I do remember as it illustrates how easy it is to overlook an animal under certain circumstances. At the time we were hotfoot on the tracks of a bear when, coming to an open spot, my shikari suddenly stopped and whispered 'Maro'. Thinking he had spotted the bear I was looking round for something black, when suddenly two four-horns dashed away and were gone before I could lift my rifle. They had been standing not 40 yards away but so well had their colour blended with the dry grass and bushes that I had completely overlooked them.

Those which I shot in the C.P. had the full four horns, but in the Nilgiris I have never obtained a head with more than two, the front pair being represented by bony lumps under the skin. There are records of their being shot on the plateau 70 or 80 years ago, when they were termed 'Elliotts' or 'Mountain Antelope', but nowadays the few that survive in the district are to be found only on the thinly bushed grass land along the edge of the great ravine known as the Mysore Ditch, at the bottom of which flows the Moyar river. It was there that the two mounted heads I have were obtained some years before the war. They are extremely wideawake little animals and it is not easy to get within sporting range, while the fact that under the Game Rules only males may be shot, renders it still more difficult to bring one to bag, since even with fieldglasses it is hard to discern such small horns. Their usual alarm note is a sharp bark very like that of the kakar but slightly different in tone. Their venison, it may be added, is the best of any antelope or deer.

SAMBAR

This grand stag is, in my experience, far more difficult to bring to bag than a tiger; that is to say a good head. In fact it was not till I had shot several tigers that I secured my first sambar, and that was barely up to average. The finest stag I have seen was in Chanda in 1907, and it was entirely my own fault that I failed to get a shot. Breaking the rule which I used to observe while in the jungle, on that particular evening I was not carrying the rifle myself. Suddenly I saw a magnificent stag standing with a few hinds under a big tree not 100 yards away, the polished points of his antlers lit up by the setting sun. There was a slight delay in getting the rifle from the shikari whose attention was attracted in the opposite direction and who consequently had not seen the animals. That delay was fatal. Before I could take aim the sambar bolted out of sight, and though I ran hard after them to the river bank which I knew was just beyond, I was still unable to get a shot as they crossed and went up the opposite side, since one or other of the hinds hid the stag from my view. What a chance lost! That was very long ago, but many things I have seen in the jungle in later years are less clear to my mind than that grand stag. Comparing my memory of him with the massive heads which I saw in the Chief Commissioner's house at Nagpur not long after, I do not think his horns can have been an inch under 45 and the spread was huge. I have never seen his like again. And that was the last Indian sambar I was to see for many years, though I did shoot two of the Malayan type in Burma near Bhamo in 1914. Unfortunately however the larger, which was an unusually fine head, was in velvet, so the horns were useless to me though my Chinese munshi made quite a good sum by selling them to be turned into 'medicine'. The other was above average for the Malayan type, but they are at the best poor trophies compared with Indian horns.

The years passed and I began to wonder whether I should ever bag a decent sambar, when suddenly I had a real run of luck. I had been acting as D.A.A.G. to the Divisional Commander during the Moplah rebellion in 1921-22, and when the permanent incumbent returned from sick leave, I managed to fit in a few days leave at Masnigudi, near the foot of the northern slopes of the Nilgiris, on my way to rejoin my regiment. In those days nearly 30 years ago Masnigudi was a splendid shooting centre. There were any number of spotted deer within easy distance and, as I was soon to find, of sambar also. On the morning after my arrival I started at dawn to work the big lantana slope between the village and the stream, and within an hour spotted a stag in the bushes not 40 yards off. A quick shot in the neck brought him down, but I was disappointed to find the horns taped only 33 inches—he was an old beast 'going back'. Next morning was blank, so when I got back to the T.B. at 9.30 a.m. I went off at once in the car towards Teppakadu, 4 miles away, to see if I could pick up a junglefowl for the pot. We had not gone far when I noticed a sambar lying down in the open forest not more than 40 yards from the road. His head was laid out flat on the ground, and except for the horns he looked very like a cow asleep. He never moved when the car stopped, and we thought him dead till I saw an eye flicker. I was in doubt whether his horns were any larger than those I had secured the previous day, but while hesitating to fire he got up and went off, and then I saw that he carried a better head with a good spread. Two running shots brought him to a halt in a thicket and a final one behind the shoulder finished him, though he stood for at least five seconds after the shot before falling. I was using a .405 Winchester which should have been heavy enough, but the sambar is a very tough animal. The horns taped two inches more than the previous one, and I was pleased to have got a shootable head at last, for in the Nilgiris a 35-incher is considered quite good. There was a wound several days old in the chest, probably from fighting, and there were maggots in the liver. This was possibly the reason for his lying down in the open. The third morning I was off again at dawn across the fields behind the T.B., and soon saw a small lot of blackbuck, but no shootable head. Half an hour later I came across a herd of four sambar and another of eight chital, each with a stag, but no better than I already had. I watched them for some time at close range, but they did not bolt till we moved. We now heard sambar belling and monkeys cursing downhill on our right near the stream, evidently at a tiger or panther, so went to investigate, and soon spotted the sambar. I could see that the stag carried a fine head, so after verifying with my glasses that the horns were clear of velvet, fired at his shoulder. I ran round the bushes and found the herd standing motionless and the stag evidently very hard hit, so gave him another. He tottered off 30 yards and fell dead in a bush, and I was pleased to find that the horns measured 37½ inches, a head worth mounting. Three sambar previously in eighteen years, and then three in three days! It was too good to last, and though I still had one stag left on my licence, I decided not to tempt Fortune further, so packed up and left. Was I guilty of slaughter? I don't think so, as I was careful not to fire except at a head bigger than I had already obtained, and none of the meat was wasted. The story of that brief trip shows how plentiful deer were round Masnigudi in those happy days nearly thirty years ago. Conditions now are very different. Hydro-electric schemes have necessitated the construction of new roads, of which car poachers (chiefly by night) have made the fullest use. The result is that over a considerable area practically no sambar or chital remain, while blackbuck have been completely wiped out.

That Masnigudi shoot remains my best memory of this grand stag, for though I have shot half a dozen more on the plateau in the past 25 years, the details do not merit narration, and my ambition to bag a 40-incher is still unfulfilled. There was indeed one such stag in the great valley behind Bangi Tappal before the war. I sighted him more than once, but was never able to get within fair range, as his habits were so largely nocturnal that it was pure chance whether one selected the right spot for him to emerge from the *shola* before the light went, and this I never succeeded in doing.

As these Jungle Memories are written more especially for the novice, a few notes may be useful, and perhaps the most important of these is *velvet*. Unlike antelope, bison etc. whose horns have a bony core, all deer (including even the humble barking deer) drop their antlers periodically and grow fresh ones. While the new horns are forming they are said to be 'in velvet' and stags in this condition are very rightly not allowed to be shot. As the horns mature and solidify the stag rubs off the outer covering against small trees, and as soon as the points are clear and hard the stag is said to be 'in hard horn', even though strips of drying velvet are still adhering to the antlers. All this is very elementary no doubt, but it took me several years to discover exactly what happens, and perhaps there may be others equally uninformed. Nearly all deer shed their horns annually, but some sambar may retain theirs for two years or more; these are old animals 'going back', i.e. the antlers having attained their maximum length progressively decrease in size. Most sambar drop their horns about April and are in hard horn again before November, but I have records in my diaries of stags seen on the Nilgiris plateau in hard horn for every month of the year. As regards annual increase in horn length, S. Haughton's *Sport & Travel* records an instance of a young sambar kept in captivity in Ceylon whose horns increased from 5½ inches in January 1877 to 25 inches in February 1882, i.e. approximately 20 inches in 5 years. It would be interesting to have more data on the subject. In the Central Provinces among picked up horns I noticed there were two distinct types as regards colour, one yellowish and the other black. These were referred to by the Gonds as 'peelia' and 'telia' respectively; in South India I have met none except the latter. A peculiarity of this deer is the curious bare patch, often raw, on the skin at the base of the neck, the cause of which is unknown. In Burma I found that all sambar had this 'sore neck', but on the Nilgiris it is not so common. The stags fight desperately during the rutting season, and once I found the bodies of two with horns inextricably interlocked near Kolimund in the Kundahs; an extra tine at the end of one antler had apparently caused the tragedy. Sambar are very difficult animals to drive owing to their natural cunning, and the best way to bag a stag is either by still-hunting or by stalking. The open grassy slopes of the Nilgiris plateau overlooking the *sholas* where they lie up for the day, afford good opportunities for the latter, and though sambar do not carry such fine heads as used to be found in the north, a keen sportsman should have no great difficulty in securing a really good specimen in the Nilgiris. Forty inches are of course rare in the south, but a fine head of 36 inches with a wide spread was bagged on the High Range of Travancore as recently as March 1951. This would be good anywhere in India nowadays.

CHITAL

Books on shikar and natural history are unfortunately only too prone to repeat without verification statements made in previous works, and thus in some cases perpetuate mistakes. One of these is the entirely fallacious idea that spotted deer in South India carry much smaller heads than those in the north. How this idea arose it is impossible to say, but even *The Book of Indian Animals* falls into the same error, for it states that 'a 34-inch antler would be good anywhere; 31 inches in South India'. Far finer horns than the latter have always been and still are available in the low country of the Nilgiris and in the Wynaad, and it is doubtful whether better can be found today anywhere in India. I might add that for many years I set myself a *minimum* of 34 inches!

Before the Mudumalai Wild Life Sanctuary was formed in 1938 that area was a favourite hunting ground of mine, and it was there and in the adjacent Doddakatti block that I obtained my best heads. Most of the bucks are clear of velvet by the end of May, and it is then that they start roaring and give a useful clue to their whereabouts. One day is so much like another—the start at dawn, the slow hunt till the herd is sighted, the endeavour to locate the master buck, the circumventing of watchful does, and the final crawl to the cover of some convenient tree or bush—that none merit more detailed narration. So I will relate one episode only, and that the story of my finest buck. During May 1923 I was in camp with the D.F.O. at Mudumalai, and late one evening came across a large herd of chital feeding over a *maidan* where the burnt grass was sprouting. There were several good bucks, but the master of the herd carried an exceptionally fine head, with a wide spread and those false points above the brow antler which add so greatly to its appearance. I had already shot the two bucks allowed on my licence, so after watching him for some time, left him in peace and returned to the bungalow. It was not till four years later that I met him again, though in the meantime I had searched long and often. On the day in question I had been out since dawn, and had fired at a good buck, but my bullet had been deflected by a branch. On the way back to the Hut, as I reached the Teppakadu cross-road I suddenly saw a small herd of chital in the bamboo jungle on my left, and with them, quite unmistakably, my old friend. They were off at once, and as the buck disappeared behind a bush; in despair I fired a snapshot through it. I did not know whether I had hit him or not, but when I ran up I was delighted to find him lying there. The bullet had entered the throat and come out at the back of the neck, and how he came to be standing at that angle I cannot imagine, unless he had paused for a final look through the bush at us. Anyhow it was one of the biggest flukes I have ever brought off! He appeared moribund, but after we had dragged him the short distance to the road he began to revive and kick, so I had to give him another quick shot through the heart, otherwise I think he would have been off. The original bullet had passed close enough to the vertebrae to stun him, but that was all. The horns were all that I expected, only half an inch short of 38 in.; and his grand head looks down on me as I write to remind me of that lucky chance. Subsequently I obtained another equally good head (but with a more narrow spread), and I know of two more shot in the same forest which taped the full 38 inches. I mention these measurements to disprove once and for all the idea that good heads are not obtainable in South India. It is true that much of the best ground is now included in the Wild Life Sanctuary, but beyond it again lie the Honurhatti salt-licks and the grassy *maidans* of the Doddakatti block so seldom visited by sportsmen, where one can still be sure of a really good head.

There are no horns so difficult to judge as those of the spotted deer. Some have a wide spread and others are narrow; some curve back while others go up almost straight, and it is therefore well before firing (especially in an area where a size limit is imposed) to view the head from different angles. The additional short point or 'sprag' at the base of the brow antler certainly indicates an old buck, as does also a dark coat, but neither of these is any certain indication of horn length, for the head may be 'going back'. So the sportsman who has bagged his buck need not be surprised to find that the antlers have shrunk two or more inches when he comes to run the tape over them! First thoughts on the size of a head will probably prove the most accurate.

Chital are far more irregular in dropping their horns than sambar, and buck in hard horn may be found throughout the year, but in the low country of the Nilgiris the majority will be clear of velvet by the end of May, and it is then that they start roaring. At this season one often hears the sound of antlers clashing as two bucks fight, but fatal results are in my experience very exceptional, though I remember one beaten buck pass close to me near Doddakatti with a gaping wound in his stomach obviously from his opponent's horn, and most bucks brought to bag will be found to bear traces of battle. Chital suffer terribly from the depredations of wild dogs, but obtain some respite at those seasons when the tall elephant grass in the Mudumalai and Benne forests renders hunting difficult, not only because scent and visibility are poor, but also because the dogs fear cutting their pads on the sharp blades of the grass. The spear grass at Anaikatti after the monsoon acts as a similar deterrent for a period.

Are there two types of chital, large and small? My old Kurramba shikari, Kempe, asserted that there were, and at his request I once shot a buck with well-formed sprags whose antlers measured only

32½ inches. This he assured me was the smaller type, but personally I think it was an old beast 'going back', though the body certainly appeared below average. Unfortunately I kept no other measurements.

THAMIN

It was in April 1913, while stationed at Rangoon, that I had my first chance at the Brow-antlered Deer, to give him his alternative name. On the advice of a friendly Conservator I went to Paungde some way up to the line towards Prome, and then marched seven miles to the Mataing forest bungalow where I camped for several days before moving further on. On my second morning after wandering about for some time, I came across a herd of half a dozen thamin, the stag being noticeably larger and darker than the hinds. I had an easy chance at 50 yards but a tree covered the stag's shoulder, and while I was trying for a clear shot he spotted me and bolted. A running shot broke a hind leg, and some dogs bailed him up in a field 300 yards on. As I ran up to finish him off I fell base over apex into a *choung* (nullah) eight feet deep, but no harm was done. The head was quite a nice one, 33½ inches with a brow antler of 15. Re-reading my diary of that trip I am amazed at the amount of game I saw. Every day I came across thamin, while *gyee* (barking deer) were so common that one or more could always be beaten out of the gardens near the village. There were several panthers about and not far away tsine were to be had. I remember too that at one camp a band of dacoits threatened to raid the village, but finally decided to wait till I had moved on. I was rather disappointed when they failed to turn up!

My best thamin was obtained on my last afternoon. We were strolling down a forest path only 1½ miles from camp when suddenly I saw three stags staring at us within easy range. Two carried quite good heads, but the third was like none I had seen. They were off before I could take aim, but my *mokso* (shikari) rushed me down the path and as we reached a clearing two cantered across my front at 50 yards range. I let them go and then as the big one passed a whistle brought him to a halt and a solid bullet from my .303 (all I had left) broke both shoulders. He went on some 20 yards and fell. The head was a magnificent one, measuring 38½ inches with a brow antler of 14½. It was of the unusual spatulated type with no less than 13 points instead of the normal six. The memory of that stag is one of my clearest mental photographs, and I still have the head to remind me of those happy days so long ago.

Are there any thamin alive in Burma today? I very much doubt it, for even before the last war they had already been shot out in many parts, and the Jap occupation and subsequent civil war must have wiped out the few remaining specimens of this fine deer.

HOG DEER

My best memory is of one knocked over with a snapshot from my .303 as it bolted across a clearing in long grass. Not a difficult shot really, and the head was not a good one, but it is the only one I have kept. While stationed at Bhamo in 1913-14 we used to go after them and anything else which might turn up, beating the grass-covered islands of the Irrawaddy with the nine Commissariat elephants (formerly King Thibaw's) which we were allowed to hire on Sundays at one rupee each. Very pleasant outings those were, though I do not recollect much ever being brought to bag. But I do remember two really good hog-deer seen in 1921 near Mandalay, neither of which afforded a shot. The first was drinking at the canal as we motored along the bank early one morning on our way out to a snipe shoot. It was gone before we could unpack our guns, and the canal effectively prevented pursuit. The second suddenly bolted out of a very small patch of scrub in the middle of a lot of rice fields while we were shooting snipe. I was loaded with No. 9 shot at the time, and before I could change to S.G. the buck was out of range. And of course both these heads were far finer than the single trophy I have. It is so often thus!

KAKAR.

More commonly known as Barking Deer, or in the Nilgiris as Jungle Sheep, this sporting little animal has provided me with lots of fun, as well as most excellent venison. But when it comes to individual memories, I must confess that I have few, many though I have shot. Some however do stand out. There was the buck that trotted out towards me in a beat near Paungde which I missed disgracefully, only to roll it over with a second shot from my .303 when it was some way off and going sixteen annas. Another stalked near Yinmabin while drinking at a water hole was missed because the bullet hit a bamboo and was deflected. Yet another near Mukerti Peak on whose shoulder the bullet exploded without penetrating but which was knocked over dead, like the chinkara referred to above; and a semi-albino shot near Avalanche many years ago whose flanks were almost pure white. A very old buck that, with exceptionally long pedicles but very short horns; obviously 'going back'.

But the one which intrigued me most of all was a buck shot near Meiktila in 1920. We were out one evening looking for thamin and from some rising ground spotted an animal feeding in some light scrub about half a mile away. It was so dark in colour that my Burmans were positive it was a thamin, though I could see with my glasses that it was a *gyee,* as the kakar is termed in Burma. Anyhow I got him and they declared they had never seen such a one before, nor had I, for that matter. The coat was exactly the same sepia colour as a thamin's, quite different from the usual tawny yellow or reddish shade of the kakar. Later I wondered whether I had not by luck obtained a specimen of Fea's Muntjac, but unfortunately both skin and skull were purloined by an acquisitive pie-dog while drying behind my bungalow, so I was unable to pursue the matter further.

The kakar is often obtained by beating, when a charge of S.G. will roll him over; the use of small shot is neither effective (except at very close range) nor sporting, and is in fact forbidden by the Game Rules in many places. The most satisfactory way is to stalk him with a rifle early in the day or late in the evening. He is such a sporting little chap that he merits a bullet in preference to a charge of shot. In the interests of game preservation only the males should be shot, but it is not always easy to differentiate, for an old female generally has tufts of hair covering fleshy knobs which look remarkably like short horns; the duller and darker coat of the male will however usually indicate the sex. Small as the heads are, when well mounted they make handsome trophies; the best I have measures just under 6 inches, excluding of course the pedicles. The latter are in my experience longer in the Nilgiris than further north and apparently increase with age. As is well known the barking deer is so called from his alarm note which is remarkably like a dog's bark. When heard, it pays to investigate, for there may be the chance of a shot at a tiger or panther, but I have known them to bark at red mongooses and even at black langurs.

MOUSE-DEER

Our list would be incomplete without some mention of the Indian Chevrotain, to give him his full name, which is almost as long as the animal itself. The first I saw was in the Poona days while beating for panther near Khandala. It passed under my tree but was of course not fired at, as I was expecting worthier game. Then for many years I never saw one, but after retirement came across them in the low country of the Nilgiris, where every year a few are shot in small game beats. The first I got was killed by chance as I was driving in the Mudumalai forest before dawn. In the indistinct light I thought it was a wild cat so ran over it. Another curious incident occurred in the Benne forest two years ago. The whole area had been burnt and young grass was sprouting. I was wandering along on the look-out for a pig when I heard a subdued grunting noise, so got behind a tree and waited. Shortly after a mouse deer ran past almost within touching distance, grumbling to himself and obviously in a very bad temper. I was just going to move on when a large red mongoose appeared, following intently the same line, and passed without seeing me. Presumably it was after the mouse deer, but what eventually happened I cannot say, as both animals went out of sight. Incidentally the flesh of the mouse deer is the best of any game animal in India; possibly the mongoose was aware of the fact, and he was not hampered, as I was, by any consideration of the close season!

(*To be continued*)

BIONOMICS OF THE MRIGAL, *CIRRHINA MRIGALA* (HAM.), IN SOUTH INDIAN WATERS

BY

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The Madras Fisheries Department has been importing Mrigal from Bengal since 1943 (Jagannathan, 1946), evidently not being aware of its natural occurrence in the Godavari and Krishna rivers, for distributing it into departmental farms in the Chingleput, North Arcot and Kurnool districts. Recently Alikunhi (1949) and Chacko (1949) recorded regular fisheries of the species from the Godavari and Krishna rivers. The fish has now been stocked artificially in the Cauvery and Tungabhadra rivers, but it is too early to say whether it has established itself in these rivers or not. The acclimatisation and growth of this species in the South Indian farms have yielded some interesting results which it is the purpose of this article to describe.

Mookerjee, Mazumdar and Gupta (1944) have studied the breeding grounds and spawning habits of Mrigal in the Midnapore district. Mookerjee and Ghosh (1945) have made preliminary observations on the food of the fish. Khan (1924, 1942, 1943) has described the spawning grounds, breeding habits and early development of the species in the Punjab. In the present communication an attempt is made to record some observations on the bionomics of Mrigal in South Indian waters.

Commercial Fishery: As already pointed out by Alikunhi (1949) and Chacko (1949), the Mrigal contributes on an average 20 per cent of the catches in the Godavari and Krishna rivers and the connected tank-systems.

Food and Feeding Habits: Mookerjee and Ghosh (1945) have stated that the Mrigal takes a mixed diet but that the animal diet is almost negligible in comparison with vegetable, and that the major portion of the diet is the higher plant bodies in semi-rotten condition. According to their findings, it would appear that the fish feeds at the bottom on organic debris. Examination of the stomach contents of South Indian specimens ranging from 2 to 30 inches has indicated that in Madras waters the Mrigal feeds mostly on blue-green algae, green algae and diatoms. Flagellates, rotifers and microcrustaceans are also consumed in very small quantities. The following is a comprehensive analysis of the diet of the fish:—

Myxophyceae: *Anabaena, Anabaenopsis Gleotrichia, Merismopedia, Microcystis, Oscillatoria* and *Spirulina;*

Chlorophyceae: *Ankistrodesmus, Closterium, Cosmarium, Crucigenia, Mougeotia, Oedogonium, Oocystis, Pediastrum, Pleurococcus, Pleurotaenium, Scenedesmus, Selenastrum, Staurastrum* and *Vaucheria;*

Bacillarieae: *Amphora, Cyclotella, Cymbella, Eunotia, Fragilaria, Frustulia, Gomphonema, Hantzschia, Navicula, Pinnularia, Stauroneis and Synedra;*

Protozoa: *Euglena, Glenodenium, Glaucoma, Pandorina, Phacus, Paramoecium* and *Stylonichia;*

Rotifera: *Conochilus, Diurella* and *Pedalion,* and

Crustacea: *Alonella, Bosmina, Ceriodaphnia, Cypridopsis, Diaptomus* and *Eucyclops.*

Mud and dark mucilaginous matter are frequently met with in the stomach contents showing that it feeds at the bottom also. There is no difference between the food of the young and the adult. The predominant herbivorous habit of the fish is indicated by its long intestine, which measured 50 feet in a specimen of 30 inches in length.

MATURITY: Practically no published data are available on the age of maturity of the Mrigal. It is generally considered that the females of the major carps become sexually mature not before they are two years old. But Mrigal fry of both sexes, about one month old, stocked in Chetpat Fish Farm, Madras, in August 1948, were found in July 1949 to have their gonads filling the body cavity. The milt was oozing from the males and the gonads of the females were in the 5th stage. Similar observation was made in June 1950 on Mrigal fingerlings stocked in the same farm in September 1949. It can therefore be assumed that the male of this species attains full maturity at the end of the first year and the female sometime later. That the males mature earlier than the females has already been recorded by Hora and Nair (1943) in the case of *Barbus* (*Lissocheilus*) *hexagonolepis*, by Chacko and Ganapathi (1949) in the case of *Hilsa ilisha* and by Alikunhi and Nagaraja Rao (1951, *in press*) in the case of *Cirrhina reba*. The number of ova in one female individual averages about two lakhs.

BREEDING SEASON AND SPAWNING CONDITIONS: The fish has been observed to spawn in the Godavari and Krishna rivers from July to September, i.e., during the south-west monsoon season, when the rivers are usually in spate. During this period, hatchlings and fry of all the major carps have been collected from the entire stretch of the rivers. Later, in October and November, fingerlings of Mrigal, are obtained from the irrigation tanks and paddy fields fed by the canals starting from the Dowleshwaram and Bezwada anicuts across these two rivers. The hydrological conditions during the spawning are generally as detailed below.

HYDROLOGICAL CONDITIONS FAVOURABLE FOR THE SPAWNING OF *Cirrhina mrigala*

Physico-chemical conditions	Godavari below anicut	Godavari near Jallakalva	Krishna above anicut
Date	22–7–48	14–9–49	21–7–49
Colour	brown	brown	brown
Turbidity (cm.)	1·5	1·5	1·2
Temperature °C	27·2	29·6	28·1
Depth of water (ft.)	5·2	10·0	10·3
Rate of flow	rapid	moderate	rapid
Dissolved oxygen (cc/1) ...	4·877	2·93	5·450
% saturation	83·7	52·2	94·1
pH	8·2	8·0	8·3
Chloride (pp. 100,000)	1·0	0·8	1·0

The hydrological conditions of the nursery areas where the fingerlings occur are as follows:—

HYDROLOGICAL CONDITIONS PREVAILING IN THE NURSERY AREAS OF *C. mrigala*

Physico-chemical conditions	Pond in the midst of paddy fields in Hussainipuram	Paddy-field canals near Ramachandrapuram
Date	20–9–49	17–9–49
Time	10.20 a.m.	4.15 p.m.
Colour	brownish	brownish
Turbidity (cm.)	5·4	5·6
Temperature °C.	28·0	33·8
Rate of flow	—	sluggish
Depth (ft.)	3·5	3·0
pH	7·8	7·6
Dissolved oxygen (cc/1)	1·89	2·93
% saturation	32·8	—
Chloride (pp. 100,000)	4·0	1·2

From a comparison of the conditions of the spawning and nursery grounds, it would be seen that the spawning grounds are characterised by (1) a lower range of temperature from 27.2 to 29.6°C (81.0 to 85.3°F. *versus*, 82.4 to 92.8°F.), (2) deeply coloured water *versus* clearer water, (3) higher turbidity (1.2 to 1.5 cm. *versus* 5.4 to 5.6 cm.), (4) higher percentage of saturation of dissolved oxygen (52.2 to 94.1% *versus* 32.8%), (5) higher range of pH (8.0 to 8.3 *versus* 7.6 to 7.8), and (6) low chloride content (0.8 to 1.0 pp. 100,000 *versus* 4.0 pp. 100,000). These differences might be due to the flood conditions in the spawning grounds as against the normal conditions in the nurseries.

Khan (loc. cit.) has observed Mrigal breeding in shallow areas of flooded streams in the Punjab during the rainy season when the temperature of water ranged from 76 to 98°C. Mookerjee *et al.* (loc. cit.) found that the Mrigal spawned in the shallow areas of the bundh-type of tanks in Midnapore district, Bengal, when the pH of the water rose from 7.4 to 7.9 after a shower. A similar increase in pH and oxygen content over the corresponding factors in the nurseries is noticed in this case also.

FACTORS INFLUENCING THE SPAWNING OF THE MRIGAL: Hora (1945) reviewing our knowledge of the breeding conditions of Indian carps, stated that a heavy monsoon flood is the primary factor that influences the spawning of Indian carps and that the other topographical, chemical and physical changes in the environment of the fish are entirely dependent on it. Mookerjee (1945), on the other hand, considers dissolved oxygen as a factor of primary importance in inducing spawning of fish. According to him practically no freshwater fish spawns without some amount of rain water mixed with the old water of the pond, and for major carps almost pure rain water is needed for spawning. But Ganapati and Alikunhi (1950) have shown that spawning depended mainly on the availability of suitable shallow spawning grounds and have pointed out how the observations of Khan (1924, 1947) also point to the same conclusion.

In the case of the Mrigal, the factors influencing spawning in the Godavari and Krishna rivers seem to be due to the availability of shallow spawning grounds. As already pointed out, the fish has been observed to spawn in the two rivers during the south-west monsoon season (July to September). Just prior to this period is the hot weather, when the rivers are almost dry exposing large areas of sandy region, and depth of water is very low and the water gets heated considerably. Specimens caught and examined during this hot period (March to June) were always in the last stage of gonadial development. That intensified respiration is necessary during the period of ovulation is well known; and this is taking place in the case of the major riverine carps during the summer months when the temperature is comparatively higher. This is also confirmed by the observations of Smith (1945) that the Mahseer only congregate at river junctions in order to become pregnant by the warmer water and not for feeding purposes as is commonly believed. Once the gonads are ripe, there is no need for intensified respiration. The fish, thereafter, seem to need a comparatively quieter period of lower metabolic activity in order that they may be able to concentrate on the only all-absorbing life instinct of spawning. The fish cannot do this act of spawning in the middle of a river in great floods, where the current is powerful. They have naturally to seek quieter shallow areas both in their own interest and of those of their spawn and fry. But with the onset of the south-west monsoon floods in the Godavari and Krishna rivers, the exposed sandy beds are covered with flood water and thus large areas of shallow portions are made available not only in the river-proper but also in the adjoining areas where streams and drainages enter the rivers. Such places are seen all along the rivers, where the fish congregate, sport among themselves and shed their reproductive elements. It will thus be evident that the availability of shallow spawning grounds is the important single factor which has to be reckoned for carp spawning. This inference is also supported by two common observations—(*a*) the inability of the major carps to spawn in confined waters (fish ponds), and (*b*) spawning taking place only in the bundh-type of tanks as in Bengal. The main difference between the fish ponds and bundh-type of tanks is the availability of shallow spawning grounds in the latter. If on the other hand, temperature is the main factor, the inability of the fish to spawn in fish ponds immediately after the onset of monsoon rains, when the right temperature of water is recorded cannot be explained. So, the main factor appears to be the availability of shallow spawning grounds.

COLLECTION OF FRY AND FINGERLINGS: The fry and fingerlings of Mrigal are usually collected by means of basket traps set against the flow of water in the numerous irrigation canals and channels. The percentage composition of the catches made by these basket traps in September 1949 was as follows.

Kind of fingerling	Percentage
Catla catla	10
Cirrhina mrigala	8
Labeo fimbriatus	10
L. calbasu	2
Cirrhina reba	10
Other miscellaneous carps, minnows ...	40
Murrels, eels and cat-fishes	20
Total ...	100

The natural nurseries of this species thus located are being utilised for stocking inland waters in Madras State. The fry and fingerlings of Mrigal stand transport well, the casualty during transhipment not exceeding 30 per cent.

GROWTH RATE: In Bengal, where the fish feeds on organic debris, the average growth is 7 inches in the course of three and a half months (Basu, 1946). In Madras, the growth is more rapid on account of its somewhat different feeding habits. The fish is found to attain a size of 18 to 24 inches and a weight of 2.5 to 4.0 lb. at the end of the first year in some of the tanks and swamps of the Godavari and Krishna districts. As these waters dry up during the summer and the pond bottom gets naturally fertilised, it is evident, therefore, that the rate of growth of this species is accelerated in such waters owing to abundance of food. In the Chetpat Fish Farm, where large areas of the bottom dry up annually, the Mrigal has attained 22 to 26 inches and 3 to 5 lb. in one year. The following is the recent record of growth rate of Mrigal fingerlings (3-5 inches) stocked in December 1949 in the Ichapur Fish Farm in North Vizagapatam, into which sullage is drained:

Month	Growth in inches
January 1950	5—6
February	5—8
March	7—9
April	9–12
May	10–14
June	12–15

The same stock of fingerlings have attained a size of 14 inches and 15 inches by June 1950 in the Dykes tank at Vizagapatam and in the Government House Farm at Madras respectively. In the former, a certain amount of sullage is drained into while the latter forms a catchment for a vast area from which dead organic matter gets drained into the tank. The average growth-rate in such fertilised waters during the first year is thus 1½ to 2 inches per month. In some other waters like the Dhobi tank, Chodavaram tank and Abbi tank in the Ramachandrapuram area, which are not so well fertilised and therefore not so rich in algal flora, the growth of the fish is poorer, being only 10 to 15 inches and 12 to 16 ounces in the first year. It is evident that the waters having abundance of algae or in well-fertilised ponds, the Mrigal can be fattened more rapidly.

IMPORTANCE IN RURAL PISCICULTURE: The easy availability of its young stages in the Godavari and Krishna systems, non-cannibalistic habit, and good rate of growth make Mrigal a valuable addition to the fishes that are utilised for rural pisciculture in the Madras State. As the Mrigal is a bottom-feeder, it is also a scavenger fish and can be used advantageously in waters containing organic debris at the bottom. Thus it can form a useful association with other species that feed mostly on the surface or in the column of the waters.

ACKNOWLEDGMENT: We are indebted to Dr. S. L. Hora for his invaluable criticism and suggestions. We are also thankful to the Director of Fisheries, Madras, for according necessary permission for publishing this paper.

SUMMARY

The Mrigal contributes on an average 20 per cent of the commercial fisheries in the Godavari and Krishna rivers. It feeds in mid-water mostly on blue-green algae, green algae and diatoms. It feeds at the bottom also. The male attains full maturity at the end of the first year. The fish breeds in the rivers during the south-west monsoon season. A comparison of the hydrological conditions of the spawning and nursery areas show that the former is characterised by a lower range of temperature, discoloration of water, higher turbidity, higher percentage of dissolved oxygen and higher pH. The availability of shallow spawning grounds in the river bed is considered to be the main factor influencing spawning of the fish. The growth-rate is rapid, about 1½ to 2 inches per month, in the first year in fertilised waters. The species is now of rural piscicultural value in Madras.

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THE BIRDS OF COORG

BY

F. N. Betts

Part I

(*With a map*)

Foreword

The following paper is intended to be a commentary on the Reports of the Surveys carried out in Mysore and Travancore and Cochin States by Sálim Ali and complementary to them. It is the result of ten years field work in which I collected eggs but no skins, and amassed a quantity of notes on habits and distribution which I hope will help to fill out the framework provided by the Surveys, along with which it is intended to be read.

The notes are entirely the result of personal observation, and in no case have I drawn on hearsay or other written sources except where expressly stated.

I have used binomials as no skin collection was made, but in practice there could have been very little risk in using the trinomials of the Mysore Survey.

A tribute is due to the thoroughness of Mr. Sálim Ali's work. In the short space of six months, covering a very wide area, and some exceedingly difficult country for the collector, I think that it is improbable that a single resident species with the exception of one or two waterfowl was missed, and his two papers in conjunction form a classic basis for the study of the avifauna of S. W. India.

Physiography and Climate

In both these respects Coorg is merely an extension of the 'Malnad' of Mysore State, with the exception of a very small area at the foot of the Western Ghats, which is typical Malabar Tropical Rain Forest, and, on the east, a tract of dry country in the Fraserpet district resembling the adjacent Mysore 'Maidan'.

The physiography of the Province is clearly defined. On the west it is bounded by the line of the Western Ghats, rising from the coastal plain at 2/300 feet elevation to peaks reaching at their maximum 5,800 ft. To the east of this range lies the main body of the Province, an undulating basin, roughly twenty-five miles broad, formed by the courses of the Cauvery and its numerous tributaries. The elevation ranges from 2,750′ to 4,000′ with a general average of 3,000′. The eastern border is marked by another range of low hills running north and south, only broken at Fraserpet where the Cauvery debouches into Mysore. North east of Fraserpet, beyond this range, lies the small but very important tract of 'maidan' country.

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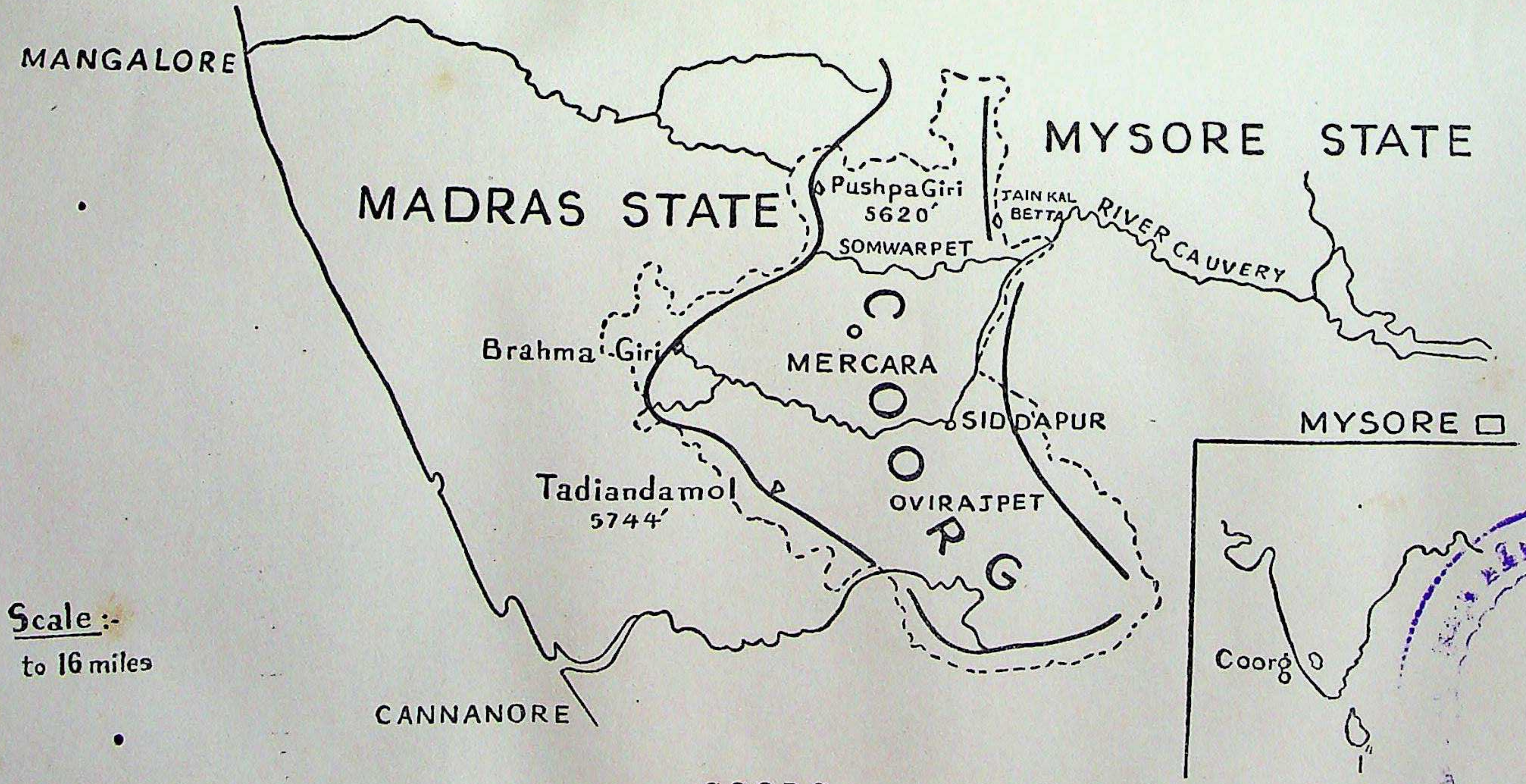
MANGALORE
MADRAS STATE
MYSORE STATE
Pushpa Giri
5620′
JAIN KAL BETTA
RIVER CAUVERY
SOMWARPET
COORG
MERCARA
Brahma Giri
SIDDAPUR
Tadiandamol
5744′
OVIRAJPET
MYSORE
Coorg
CANNANORE
Scale :-
to 16 miles

COORG

V·50/1, B63J
48919
3095

METEOROLOGY

The climatic zones correspond very closely with the geographical. By far the greater part of the rainfall is precipitated during the S. W. monsoon. Irregular showers begin in April and May; steady rains follow through June, July, and August with strong westerly winds. A break occurs in September, followed by the thunder showers of the N. E. monsoon in October. From November till the end of March, except for one or two showers, there is seldom any rain.

Western Ghats: The rainfall on the western slopes is enormous: 250+″. The Malabar foot is always moist and hot, varying little in temperature throughout the year. On the hill tops the monsoon months are probably generally the coldest on account of the strong winds, but the very highest peaks are occasionally touched by frost in winter.

Central Basin: The rainfall decreases very rapidly from west to east. On the eastern slopes of the Ghats as much as 150″ is experienced, while the eastern ridge receives no more than 50/60″. The average over most of the basin is 60/80″. The climate is remarkably equable, the temperature rising occasionally to 90° for a few days at the end of March before the first rains which is the hottest time of year. The summer is cool on account of the rain and strong winds of the S. W. monsoon, while, even in the winter, the nights rarely drop below 55°.

Dry Zone: Here the rainfall is less than 40″, a good deal of which falls in the N. E. monsoon, and summer temperatures are much higher.

BIOTOPES

The following biotopes are clearly distinguishable. A full description appears in Sálim Ali's paragraphs on the Mysore Malnad and Maidan and only a brief recapitulation is made here.

Wet Zone:

The Malabar coastal plains and the western face of the Ghats. Up to 4,000′ this is covered in dense Tropical Evergreen Forest (Champion, Group 16, Type C). Above this height the forest, while remaining evergreen, becomes dwarfed and less tropical in character. The peaks are usually bare of trees and under short grass, and are often crowned with cliffs and rocky crags.

Intermediate Zone:

Moist Intermediate: This comprises the eastern slope of the Ghats and that part of the central basin immediately at their foot. The slopes of the hills are under short grass interspersed with evergreen sholas, mostly small trees with an undergrowth of 'eeta' bamboo, rattan canes, and *Strobilanthes*. Cardamom and coffee plantations grown under shade cover considerable areas, and the valleys are mostly under paddy cultivation often with thickets of *Pandanus* along the streams. There is little *Lantana*. Forest types: Southern Tropical Semi-evergreen (Group 2A, Type C2).

Dry Intermediate: This lies to the east of the last, generally at a lower elevation and comprises the greater part of the central basin. It

पुस्तकालय
गुरु [illegible] ड़ी

is the most thickly populated area. Cultivation consists of wide stretches of paddy land along the streams especially in the south; coffee, pepper, and orange plantations. The coffee is grown under shade usually of mixed types, both indigenous and exotic, including such species as *Grevillea robusta*, *Terminalia tomentosa*, *Dalbergia latifolia*, *Erythrina lithosperma*, *Bombax malabaricum*, and various varieties of *Ficus* and *Albizzia*. A great number of these bear fruit and flowers attractive to birds, while the large numbers of standing dead trees, ringed during shade control operations, provide unlimited breeding sites for hole-nesters, with the result that the coffee land probably carries a greater and more varied bird population to the acre than any other form of agricultural activity in the whole of India.

Lantana aculeata in impenetrable thickets covers all open land not kept under cultivation or steadily grazed. In the north of the area, particularly, there are considerable stretches of grassy downland, known as '*bane*', kept down to a short turf by hordes of hungry cattle.

Deciduous Forest Belt: A strip ten to fifteen miles broad running all along the eastern border of the central basin and including the eastern ridge. This is uninhabited reserved forest, mostly Southern Tropical Moist Deciduous, (Group 3A–Type C1), characterised by Teak, Nandi, Matti, Rosewood, and other valuable hardwoods intermingled with the thorny, deciduous, giant bamboo *Bambusa arundinacea*. In the dry country beyond the eastern ridge it merges into Southern Tropical Dry Deciduous (Group 4A, type C2) of a scrubbier type with little bamboo.

Dry Zone:

This is characterised, on the flat land along the Cauvery, by typical Mysore 'Maidan' dry cultivation; ragi, sorghum, and oil seeds and pulses. The uncultivated portion is mostly open short grass and scattered thorny scrub with much lantana (Southern Thorn-Group 5A). There are a number of low rocky ridges running parallel to the main eastern ridge, and one or two small tanks, the largest, Halagote, not more than fifty acres in extent, which provide the only habitat for waterfowl in the whole Province.

GENERAL NOTES ON THE AVIFAUNA

Before coming to a detailed consideration of the birds of the Province, there are one or two very striking general features which call for comment.

MONTANE SPECIES

A number of species occurring, in most cases commonly, on the Nilgiri Plateau appear to be completely absent from Coorg even in apparently similar facies at the higher elevations on the Ghats. In most cases the Mysore Survey found them in the Billigirirangan Hills, while one or two turned up again in the Bababudans. These latter hills being north of Coorg, the birds concerned may yet turn up in the Province. Nevertheless the Billigiris do seem to form a very definite limit to the distribution of a number of species. This is quite understandable, as these hills, though cut off from the main tableland by the deep but narrow valley of the Moyar River, are really an extension of the Nilgiris, which are separated from the main spine of the N. Malabar and Coorg Ghats by the broad Wynaad plateau at an elevation of only 3–3,500′.

1. *Trochalopteron cachinnans.*

Confined to the Nilgiris. *T. jerdoni* is supposed to occur in Coorg, but I am fairly sure this is a mistaken report, although there is plenty of the *Rubus* facies so attractive to these birds on the high hills.

2. *Brachypteryx major.*

Common in Nilgiris and Billigiris. Frequent in Bababudans.

3. *Parus major.*

Very common on the Nilgiris and found in Billigiris, but rare in Coorg and there only in the Dry Zone.

4. *Oreocincla dauma.*

Nilgiris and Billigiris, but always rare and easily overlooked.

5. *Eumiyas albicaudata.*

Nilgiris, Billigiris and Bababudans. A common and conspicuous bird in the Nilgiris, but must be very rare if at all occurring in Coorg.

6. *Ochromela nigrorufa.*

Nilgiris and Billigiris.

7. *Anthus nilghiriensis.*

Nilgiris only.

8. *Alauda gulgula.*

Nilgiris only.

9. *Saxicola caprata nilgiriensis.*

The Coorg bird is almost certainly subsp. *caprata*, as it avoids the high downs beloved by the Nilgiri Bushchat, and inhabits an entirely different biotope.

10. *Hirundo javanica domicola.*

Nilgiris only.

ECOLOGICAL PARALLELISM IN THE WET AND DRY ZONES

In Coorg there are two very markedly distinct faunal zones, one including the Wet and Inter Zones, and the other the Dry Zone. The boundary is most definite and runs along the crest of the eastern ridge, though certain Dry Zone species do wander across this in the dry weather. One has only to cross the ridge to find a completely new set of birds. While there are many forms which are represented solely in one zone or the other, a remarkable and immediately noticeable parallelism exists, in which a species on one side is replaced by another nearly related species on the other side, occupying the corresponding ecological niche.

TABLE OF ECOLOGICAL PARALLELS

	A. Wet Zone	B. Dry Zone
1.	*Dendrocitta leucogastra* (West only)	*D. vagabunda* (Inter. and Dry)
2.	*Sitta frontalis* (W. and I.)	*S. castanea* (D.)
3.	*Turdoides somervillei* (I.)	*T. striatus* (D.)
4.	*Otocompsa jocosa* (W. and I.)	*Molpastes cafer* (I. and D.)

These two species overlap throughout most of their range and are only found separately at the two extremes.

	A. Wet Zone	B. Dry Zone
5.	*Iole icterica* (W. and I.)	*Pycnonotus luteolus* (D.)
6.	*Lanius schach* (W. and I.)	*Lanius vittatus* (D.)
9.	*Tephrodornis gularis* (W. and I.)	*T. pondicerianus* (D.)
10.	*Pericrocotus flammeus* (W. and I.)	*P. peregrinus* (D. I. and D.)
11.	*Dicrurus macrocercus* (W. and I. as Winter migrant)	*D. coerulescens* (D.)
12.	*Oriolus oriolus* (W. and I. as Winter migrant)	*O. xanthornus* (D.)
13.	*Acthiopsar fuscus* (W. and I.)	*Acridotheres tristis* (D.)
14.	*Uroloncha striata* (W. and I.)	*U. malabarica* (D.)
15.	*Galerida malabarica* (W. and I.)	*Mirafra affinis* (D.)

Perhaps this is hardly a fair case, as though the two are the representative larks in their respective Zones, their habits are somewhat different.

	A. Wet Zone	B. Dry Zone
16.	*Dryobates hardwickii* (W. and I.)	*D. mahrattensis* (D.)
17.	*Chrysocolaptes guttacristatus* (W. and W. I.)	*C. festivus* (D.)
18.	*Megalaima rubricapilla* (W. and I.)	*M. haemacephala* (D.)
19.	*Psittacula cyanocephala* (W. and I.)	*P. krameri* (D.)
20.	*Psittacula columboides*	*P. eupatria*
21.	*Merops orientalis* (Winter—W. and I; Summer D.)	*M. superciliosus*
22.	*Tockus griseus* (I.)	*T. birostris* (D.)
23.	*Caprimulgus indicus* (W. and I.)	*C. asiaticus* (D.)
24.	*Glaucidium radiatum* (D.)	*Athene brama* (D.)
25.	*Dendrophasa pompadora* (W. and I.)	*Crocopus phoenicopterus* (D.)
26.	*Streptopelia orientalis* (W. and I.)	*S. senegalensis* (D.)
27.	*Streptopelia chinensis*	*S. decaocto*
28.	*Cryptoplectron erythrorhynchum* (W. and I.)	*Perdicula asiatica* (D.)

LOCAL MIGRATION

Besides the annual influx of migrants from beyond the northern borders of India, there is a considerable local migration of resident species, generally in an east and west direction. Such insectivorous birds as Swifts and Bee-eaters move down into the Dry Zone after breeding to avoid the heavy rains of the monsoon, while other species, which breed in the Dry Zone, wander up into the Inter and Wet Zones in the dry season.

Apart from these however, there are some half-dozen species, nearly all common Indian plains types, which are extremely numerous all over Coorg in the winter months but which do not breed in the Coorg Dry Zone nor in the adjacent parts of the Mysore Maidan. Where they do breed is a problem which has yet to be solved. A list is appended.

1.	*Tchitrea paradisi*	
2.	*Dicrurus macrocercus*	*D. coerulescens* is the resident breeding Dry Zone species.
3.	*Dicrurus longicaudatus*	
4.	*Oriolus oriolus*	*O. xanthornus* is the resident, breeding Dry Zone species
5.	*Clamator jacobinus*	
6.	*Eudynamis scolopaceus*	May breed in Dry Zone.
7	*Merops orientalis*	Small numbers breed in the Inter. Zone, more in the Dry Zone but nothing like enough to account for the numbers of winter visitors.

SYSTEMATIC LIST

Corvus macrorhynchos: The Jungle Crow.

Widely spread throughout Coorg, occurring chiefly in cultivated country and round towns and villages, but also in deciduous forest as anyone who has been big game shooting will know. They are the first birds to find a carcase, long before the vultures arrive. They nest from January to March. The nests are usually built high and inaccessibly in the outer or topmost branches of a tall tree. One I examined consisted of a rather scanty foundation of large sticks, surmounted by whippy twigs and stout rootlets, with a cup lined with fine rootlets and coir. The latter is a favourite lining material. In the Nilgiris I have seen wool used. In my experience, one bird, presumably the female, does all the building, her mate accompanying her to and fro in the search for materials but not contributing any himself. The same nest is not used twice though a pair will breed in the same locality year after year and there may be a number of old nests in existence together. Four or five eggs are laid, and only one brood seems to be raised. Moulting birds may be seen in August.

Corvus splendens; The House Crow.

Confined entirely to the towns and not numerous there. I have seen them in Fraserpet and Virajpet, elevation 3,000′, but not in Mercara, 4,000′. A solitary pair lived for a long time in Somwarpet, 3,500′, but always appeared much harried and chased by their more numerous and powerful jungle relatives. I have no records of breeding.

Dendrocitta vagabunda; The Tree-pie.

Common and widely-spread throughout Coorg, occurring equally in the Dry Zone, deciduous forest, and Inter-Zone but not in the evergreen forest of the Ghats. It is one of the typical members of the coffee plantation avifauna and is always conspicuous in the mixed flocks which are such a feature of the non-breeding season. The often recorded association of this bird with *Dissemurus paradiseus* is an obvious fact, but as Sálim Ali says in the Travancore Survey, may be simply due to a community of interests. The two species are the largest, noisiest, and most aggressive members of the mixed flocks, and take it upon themselves to act as policemen, being the first to chivy any hawk, owl, mongoose, or snake that appears on the scene. Nevertheless the association does seem to be more than fortuitous, as it continues after the flocks break up, and I have on more than one occasion found the two species nesting in adjoining trees.

In Coorg, March is the usual breeding month. The nests are scanty, flimsy cups of thin twigs built high up in the topmost branches of a tall tree in light woodland. The tree chosen is usually leafless at that time but the nests, though in consequence in full view, are by no means conspicuous owing to their small size.

This bird is quite omnivorous. Fruit, especially various wild figs, nectar from the blossoms of *Bombax* or *Erythrina*, insects large and small, lizards, young birds, or eggs are all equally acceptable.

Dendrocitta leucogastra: The Southern Tree-pie.

Confined to the heavy evergreen forest of the Wet Zone and the *sholas* on the Ghat slopes. Here it replaces the last bird, but is never common. It is as noisy as its relative but lacks the mellow, metallic, fluty notes of the latter. I have not found a nest though it undoubtedly breeds in Coorg.

Parus major: The Grey Tit.

Very rare in Coorg. I noted this bird in my original 'Notes on the Birds of Coorg' (*J.B.N.H.S.* 1928) as being fairly common in Pollibetta, but this was incorrect. The only place I have actually met it is in the Dry-Inter deciduous forest of the eastern ridge, at Sige Hosur on the edge of the Dry Zone. It occurs again over the border in the Mysore Maidan. This restriction to dry biotopes is remarkable considering that it is very common at high elevations in the Nilgiris in the moist, evergreen *sholas* on the plateau. I have not found the nest in Coorg. In the Nilgiris and Ceylon holes in stone walls are commonly used.

Machlolophus xanthogenys: The Yellow-cheeked Tit.

Typically a bird of the coffee plantations of the Inter-Zone, neither extending into the Dry Zone, nor to the higher elevations of the Ghats, though it is to be found in Moist-Inter forest. In the Nilgiris they are common up to 4,500′ above which height they are replaced by the last species. They live in family parties throughout most of the year, and are constant members of the mixed flocks. They are typical tits in their ways but are strictly confined to woodland country. One used to roost regularly in a hole in a branch of a tree in my garden. The only nest I have examined was found on 11th October in an old barbet hole eight-feet up in a tree stump in a coffee clearing; it contained fully-fledged young. The nest was a compact pad of felted bark, fibres, and hair. I saw the young being fed on cockroaches, grubs, and a large green caterpillar. Other nests I have marked have been in inaccessible sites in old Coppersmith holes high up in dead and rotten trees. My only clutch record is three.

Sitta castanea : The Chestnut-bellied Nuthatch.

Scarce and more or less restricted to the Dry Zone round Hebbale. Strangely enough I have once seen one in my garden in the Inter-Zone. It was in company with a *S. frontalis* at the time so that there was no doubt of the identification. I have not found the nest.

Sitta frontalis : The Velvet-fronted Blue Nuthatch.

A very common bird in coffee in the Inter-Zone, an invariable member of the mixed flocks. It is also found on the Ghats up to the highest *sholas*, and regularly if less commonly in the deciduous forest belt. I have not actually found a nest, but I saw a bird flying about with a feather in its bill on March 29th, and saw a pair on Jan. 21st both collecting down from seeding weeds growing on a fallen log. Judging by the appearance of young birds, breeding extends from January to April.

Garrulax delesserti : The Wynaad Laughing-Thrush.

Confined to the heavy evergreen jungle of the Western Ghats. I have only come on them in deep, virgin forest at elevations ranging from 1,000′ on the Iritti Ghat to 5,000′ in the belt of *Wate* bamboo, which grows at that height on the upper slopes of Pushpagiri. They live in very large flocks of 40 or 50 birds, whose noisy calls may be heard at a great distance. They are very tame and inquisitive and are extremely sociable, four or five frequently perching on the same twig and preening each other's feathers. I have no breeding notes.

Trochalopteron jerdoni : Banasore Laughing-Thrush.

Recorded from the Coorg and Wynaad Hills in the New Fauna. Davidson is reported to have obtained it in the Brahmagiri Hills in the south of the Province. It seems most improbable that this species should occur so far north, cut off by *T. cachinnans* in the Nilgiris from its other races. One might well expect to find *T. cachinnans* as its favourite *Rubus* facies exists in quantity on the higher Ghats, but it does not occur.

Turdoides somervillei : The Jungle Babbler.

A common bird in the deciduous forest belt especially among bamboo, and on the outskirts and clearings. It occurs frequently, but apparently rather as a stray in the coffee and *Lantana* and parkland typical of the Inter-Zone. It is found in flocks of up to a dozen usually travelling in company with other species. They feed mostly on the ground, scuffling noisily among the dead leaves, the individuals playing follow-my-leader through the undergrowth, only appearing at the tops of the bushes to take flight to a new feeding ground. They do not penetrate into the Wet Zone of the Ghats nor are they found above about 4,000′. Their place here is taken by *Argya subrufa*, but though the ranges of the two species overlap, they do not intermingle. On the other border however, where they meet *Turdoides striatus*, both species associate freely. The only nest I have seen was found on April 20th four feet from the ground in a coffee bush. It was a rough cup of coarse grass and roots, and could hardly be said to have been lined though perhaps the innermost grass was finer in texture. There were two unincubated eggs.

Turdoides striatus : The White-headed Babbler.

This species takes the place of the last in the Dry Zone scrub country. Its habits are in every way similar to those of *T. somervillei*. It is abundant wherever there is thick scrub jungle and *Lantana* brakes, and is extremely noisy, and assiduous in mobbing and abusing any hawk, owl, or beast of prey that it finds on the move. A nest was found on May 25th, seven feet up and well-concealed in a small, creeper-grown thorn-tree in thorny scrub jungle on a rocky ridge. It was the usual large, loose cup of dried grass and contained two eggs, quite fresh, and probably not a full clutch.

Argya subrufa : The Rufous Babbler.

A bird mainly of the evergreen *sholas* of the Ghats. Sálim Ali apparently met it only up to 3,500′, but in Coorg it is more common above 4,000′ than below, and I have seen it up to the highest summits. It prefers a facies where long grass is intermixed with the scrub and trees, and abandoned paddy fields are a very favourite haunt. In one such, on the estate on which I lived, a flock could always be found during the seven years I was there, and never seemed to wander far away. They are even greater skulkers than *T. somervillei* and just as noisy. They appear to be monsoon breeders. I caught a newly flown juvenile in the Nilgiris on Sept. 1st and found a nest with young ready to fly in Coorg on August 13th. This was in a small bush in a little clearing in the thick secondary vegetation growing in a sandalwood plantation. The old birds were noisily demonstrative, giving away the site by their abuse. The nest, with other old ones which I have seen, was quite distinctive, being a large, very loosely-knit cup made entirely of the twisted stems and tendrils of honeysuckle or some similar creeper, with an apology for a lining consisting of a few rootlets.

Pomatorhinus horsfieldii : Horsfield's Scimitar Babbler.

This bird occurs throughout Coorg, though nowhere in great numbers, from the highest Ghat *sholas* to the scrub jungle of the Dry Zone. It is probable that both the typical race and *travancoriensis* inhabit the Province but this remains to be proved. They are usually seen in pairs, sometimes alone, but more often in the mixed flocks. They are more arboreal than the preceding babblers, and their favourite feeding grounds are the mossy limbs of forest trees, along which they work, probing the crevices with their long, curved bills. They appear to breed in the cold weather. I have twice found the nest. One on Dec. 21st was a loose ball of dead leaves which fell apart at a touch, placed in full view on the upper surface of a coffee bush two feet high. There were two fresh eggs. The other, containing a chick about four days old and an addled egg on Jan. 10th, was in the Dry Zone at the foot of a lantana bush on the steep slope of a rocky ridge. The thorny runners hung down and protected the nest, which was nothing-more than a domed ball excavated out of the tangle of dead leaves and grass lying against the bank. The entrance was woven of dry grass with a slight platform of the same material in front. When feeding and unexcited their note is a low, croaking chuckle, but under stress of emotion they burst into a whirring call terminating in a series of mellow '*wok*, *wok*, *wok*'s.

Dumetia hyperythra [albigularis]: The Small White-throated Babbler.

In Coorg I have only met this bird in thorny scrub and grass jungle in the Dry Zone at about 3,000′. They do not occur or are rare in the Inter-Zone and the Ghat slopes, though on the Nilgiris I found them common on the edges of *sholas*, and have found a nest at 5,000′. They are typical little babblers in their ways, wandering through the undergrowth in small flocks, keeping in touch with low calls not unlike those of *Rhopocichla.*

My Nilgiri nest was on the ground on the banks of a watercourse running through elephant grass and dwarf date palms. It was cunningly concealed under the fronds of a date, and was a neat ball woven of dry date leaves and grass without lining, and with the entrance at one side. There were two fresh eggs on 21st May.

Chrysomma sinensis: The Yellow-eyed Babbler.

Confined as far as Coorg is concerned to the Dry Zone where it is not uncommon in open, scrub-grown wasteland. A skulker like most babblers, it is usually seen in small flocks, but occasionally singly or in pairs. It has a sweet and quite powerful song. I found a nest which I believe was attributable to this species in a *Buted frondosa* sapling, two feet from the ground, on June 14th. It was a deep and well-built, conical, cup of grass-blades so thickly bound with cobweb that it was almost white in colour.

Pellorneum ruficeps: The Spotted Babbler.

Very common in the Inter-Zone and the Ghat *sholas*, and less numerous in the Dry Zone, though I have found it breeding there. It is partial to coffee cultivation but is seldom seen, being the most confirmed skulker of the clan. Its sweet call note–'*pee*, *pee*, *peeea*'– is a very common bird sound at certain times of the year, and besides this it has in the breeding season a song, quite distinct from the call, but of the same timbre. Except when nesting it is seen in small flocks which keep entirely to the undergrowth and find most of their food on the ground. I have found nests from the end of February to April. They were all in very similar situations, in drifts of dry leaves at the foot of bamboo clumps or lantana bushes, and were very flimsy, domed affairs, made of the surrounding dry leaves, with the exception of one which was of grass. The cup is sunk below the outer level and lined with grass. Two eggs form the clutch.

Alcippe poioicephala : The Quaker Babbler.

One of the commonest birds in the Ghat *sholas* and evergreen forest up to 5,000′. It is fairly numerous in coffee in the Inter–Zone, and wanders into the Deciduous Forest, especially along ravines with strips of evergreen growth along their slopes. It occurs in larger flocks than the last species and is more arboreal, but keeps to the interior of the woods, seldom venturing into the open or flying far. Tall *Strobilanthes* undergrowth is what it loves above all. It has a number of churring and chattering call notes. The song, often heard in the first half of the year, consists of four sweet notes, not unlike those of the Spotted Babbler. Nests I have found have all been built in the undergrowth of evergreen *sholas*. They were in small, isolated shrubs, three or four feet from the ground, and were quite conspicuous. They were substantially, though roughly-built cups of green moss, lined with black rhizomes. Two eggs form the clutch. Nesting mostly takes place from February till April but I once saw a newly-fledged juvenile in August so that the season probably extends throughout the monsoon.

Rhopocichla atriceps: The Black-headed Babbler.

Very common wherever evergreen forest occurs up to the highest elevations, and to be found even in the small patches of evergreen growing along ravines in the deciduous forest. Plenty of undergrowth; *Strobilanthes*, rattans or young trees are essential to their requirements, and cardamom cultivation is a very favourite resort. They are not arboreal birds, and seldom venture more than a foot or two above the ground, skulking through the undergrowth in considerable flocks of a dozen or more. Normally they are very quiet but on being alarmed set up a tremendous 'churring', audible at a considerable distance. They have a passion for nest-building and in any of their normal haunts one will probably find a nest every hundred yards or so at any time of year. They are very rough balls of dead leaves six to eight inches in diameter which fall to pieces at a touch, jammed into a fork of a shrub at two or three feet from the ground, and without lining. These nests are not used for breeding, though the birds certainly roost in them at times, if not regularly. The real nests are similar in design but much more carefully built, and lined with black rhizomes and grass. They are very well hidden in thick herbage within a couple of feet from the ground, often on the edge of a *shola*, whereas the 'cock' nests are usually inside. One exceptional one I have seen was quite as roughly built as a 'cock' nest but lined. There appear to be two breeding seasons, before and after the monsoon. Nests found with eggs in March, April and again in September. The usual clutch is two eggs.

Aegithina tiphia: The Iora.

Common all over Coorg except on the higher hills of the Ghats, but most numerous in the Inter and Dry Zones. Parkland, orchards, and open, cultivated country are preferred to forest. Common and brightly coloured as it is, it is a bird which is heard more often than seen, as it keeps much to the tree-tops where the green and yellow of its plumage blends with the leaves. It usually goes about in pairs which are almost invariable members of the mixed flocks. In the breeding season, the cock has a pretty display, flying up vertically for a few feet, and descending with wings and tail outspread and all his feathers fluffed out, especially those of the white rump, till he looks like a little ball. The nesting season appears to be extended but the nests are hard to find. April and May seem to be the chief months, but I have found one in August. They are beautifully made, shallow cups not more than two and a half inches in diameter, built of shreds of bark so covered externally with cobweb as to be almost white in colour, and lined with a little grass. I have seen them four feet up in a coffee bush, or thirty feet up in a big fig tree. They are slung in a horizontal fork of an outlying twig. Both birds assist in building and brooding, but in one case which I watched, the cock did not feed the young himself, but handed over the green caterpillars which he brought to the hen for distribution.

The Iora is the favourite host in Coorg for the Banded Bay Cuckoo.

Chloropsis aurifrons: The Gold-fronted Chloropsis.

Common throughout the Inter-Zone and the lower slopes of the Ghats, and extends into the deciduous forest. It is a noisy bird, and owing to its green colour and its fondness for thick evergreen tree-tops, it is far more often heard than seen. Flowering trees in blossom particularly *Bombax*, *Erythrina*, and *Acrocarpus* are a certain attraction. One or two pairs can usually be seen in any of the mixed flocks. The song is an extraordinarily loud and voluble rattle, and the bird is an excellent mimic, introducing the calls of all sorts of other birds with remarkable verisimilitude. I have never been able to find a nest, but the season is probably prolonged as juveniles in immature plumage may be seen both before and after the monsoon.

Chloropsis jerdoni: Jerdon's Chloropsis.

Occurs, but without considerable collecting it will be difficult to determine its status as it is so similar in habits and field appearance to the last species. I suspect however, as remarked by Sálim Ali in the Travancore Survey, that it tends to replace *C. aurifrons* in the Dry-Inter and Dry Zones.

Microscelis psaroides: The Black Bulbul.

Very common in the hill *sholas* above 4,000′. It is a great wanderer in the cold weather, and may then be found in large, noisy flocks in the Inter-Zone, especially where there are any nectar-bearing trees in flower. In the Nilgiris I found that they mostly left the very wet western face at the onset of the S. W. monsoon after breeding. The flocks follow each other from tree to tree with harsh grating calls, and they are entirely arboreal, never coming near the ground. Their food seems to be chiefly berries of various sorts and nectar when obtainable. Breeding takes place from March to May, the favourite localities being the edges of *sholas* from 4,500′ upwards, where the trees become stunted and thin out into the grass downs of the tops. The nest is a neat cup of green moss lined with grass. It is very shallow, and small for the size of the bird, and is placed in an outlying horizontal fork of a small, moss-grown tree at ten to fifteen feet from the ground, being far from easy to spot. The usual clutch is two.

Molpastes cafer: The Red-vented Bulbul.

The distribution of this species in relation to *Otocompsa jocosa* is rather peculiar. In the Dry Zone scrubland, *M. cafer* is the predominant species, though *O. jocosa* occurs. Throughout most of the Inter-Zone both species are common with *O. jocosa* predominant. In the Wet Zone evergreen above 4,000′, *O. jocosa* is found alone. Yet in the Pollibetta district, *c.* 3,000′, Inter tending to Dry-Inter, *O. jocosa* is very numerous, and *M. cafer* scarce, while round Mercara, *c.* 4,000′, wet evergreen, *M. cafer* abounds.

Fairly open country is its main requirement. It is usually seen in pairs throughout the year. Fruit and berries are the principal food, but numbers of insects are consumed especially when there are young to be fed, and they take part eagerly in the general crusade against the emerging swarms of termites at the beginning of the rains.

The nest is usually built higher up than that of *O. jocosa*, and though similar to that of the latter, can be recognised with a little practice. A favourite site is at the end of a pollarded branch of an isolated tree, concealed in a tuft of leaves. A solid foundation is preferred and the nest is seldom built in a bush or at the end of slender twigs. The most unusual site I have seen was on a verandah rafter of a bungalow. It is often well hidden, but I have found nests in leafless trees, visible at a great distance. Fine twigs and midribs of dead leaves are woven into a neat cup, lightly bound on the outside with cobweb, and lined with grass. Two, and less commonly three eggs form the clutch. Breeding goes on through most of the year with peak periods in March/April and again in September.

Otocompsa jocosa: The Red-whiskered Bulbul.

One of the commonest birds of Coorg from the highest to the lowest elevations only absent from the Interior of the Wet Zone Forests and becoming scarce in the Dry Zone scrub. It is one of those species that appear to flourish solely through their omnivorousness, adaptability and fecundity. It is on the whole chiefly a berry eater, but all kinds of insects are grist to its mill, and much damage is done in gardens among young peas and seedlings. The nests may be built anywhere, seldom at any great height and sometimes almost on the ground. They are sometimes well-concealed, but frequently are very conspicuously placed in some small isolated bush, and the bird who is a close sitter gives the site away by her agitated departure at the last moment. It is safe to say that any seasons's birds-nesting will yield as many nests of this species as of all other birds put together.

Being so accessible and easily found, the casualties are enormous, but the birds breed steadily throughout the year and seem to have no difficulty in making up for the losses. The nest is a fairly neat cup, flimsily built of fine twigs and dead leaves, and lined with grass. I have seen one lined with hair. It is placed in any sort of small bush. The clutch is two, less commonly three.

The young when first hatched are fed entirely on insects but as they grow older, berries are brought to them. These bulbuls are regular members of the mixed flocks, usually in pairs, but occasionally loose parties of twenty or more may be seen. The jaunty black crest is always carried erect except when in flight or brooding.

Iole icterica: The Yellow-browed Bulbul.

A forest species, very common through the wetter, well-wooded parts of the province. It does not however ascend much above 4,500′.

and despite Mr. Sálim Ali's remark in the Travancore Survey, I found that this was usually its definite limit in the Nilgiris, though wanderers may go higher for short periods. It extends into the deciduous forest wherever there is a certain amount of evergreen vegetation along rivers and damp ravines. It does not care for cultivation though a fair number visit coffee plantations if there is forest close at hand, and I have found them breeding there. They are arboreal birds, noisy and cheerful, with a variety of loud, mellow notes. They are mainly frugivorous, and like all bulbuls are very fond of nectar. Breeding takes place mostly in Feb./March extending to May. The nest is quite unlike that of other members of the family. The usual site is in a thinly-foliaged, isolated shrub in the interior of light forest. In most cases it is within five feet of the ground, though an exceptional one was built in my garden at the end of a bough in a tall tree at fifteen feet. It is a slightly built hammock of grass and skeleton leaves, slung in a horizontal fork with a certain amount of cobwebs and green moss on the exterior, and lined with grass or black rhizomes, and looks very much like a large White-eye's nest. The normal clutch is two. I confirm Sálim Ali's note that the young do not resemble the adults. They are a general dull brown all over the upper parts, head, and breast and lack the general yellowish tinge of the adults. The only yellow is on the flanks.

Pycnonotus gularis : The Ruby-throated Bulbul.

A common species throughout much of Coorg. It is definitely a forest bird, avoiding all forms of cultivation, even coffee, but in spite of this is far from shy. While found in deciduous forest, it prefers evergreen, and extends from the foot of the Ghats up to 4,000′, seldom higher. Its most favourite haunt is the mixed stand of bamboo and evergreen on the borders of the wet and Inter-Zones. It is usually seen in pairs which keep in touch with a low, constantly uttered call-note, and in addition it has a sweet, tinkling song. It is a tree-living species, finding most of its food in the forest canopy, feeding on a variety of fruit and insects. Lantana berries are largely eaten. I have found nests from the end of February to early April. The favourite site is on the edge of a patch of evergreen jungle. They are from ten to twenty feet up in a thick-foliaged tree, often covered in creepers. From below they are almost impossible to detect, as they are very small and consist of a few large, yellow, dead leaves bound lightly with cobweb, and look just like a casual, wind-blown accumulation of rubbish. The rim is bound with grass stalks and there is a slight lining of grass. Two has been the clutch in all nests I have seen.

Pycnonotus luteolus : The White-browed Bulbul.

A bird of dry, open country and scrub jungle. It is common in the Dry Zone, and also occurs in the Inter-Zone in the patches of '*bane*' land, grazing ground with short grass and scattered clumps of lantana and small trees, which are to be found particularly in the north of the province. It avoids continuous forest of any kind, and will not be found above 3,500′. It is as arrant a skulker as any babbler, and is usually seen in pairs or singly, never in flocks. It keeps entirely to the interior of the scrub thickets, only emerging from one brake to make a quick dash across to another. Were it not for its loud call, a rattling succession of five or six notes, its presence would go undetected. The nest is not easy to find as the birds are so shy, and avoid showing themselves in the vicinity. The only two I have come across were built in January and March respectively. One was in a small, scantily-leaved bush in undergrowth under a clump of trees; the other in an isolated thorn bush in a patch of lantana scrub. Both were within three feet of the ground and might have been taken for those of *O. jocosa*, but were even more untidily and loosely-built with very little cobweb in the construction.

Microtarsus poioicephalus : The Grey-headed Bulbul.

This species is confined to heavy evergreen forest, especially along the banks of rivers, or swampy ground where the trees are overgrown with lianas and rattan. It occurs on the Ghats from sea-level up to about 3,500′, and is found in the Moist Inter-Zone wherever suitable facies exist, but avoids cultivation with the possible exception of cardamom *sholas*. It is decidedly local, but where found at all is usually numerous. The pairs or small parties keep to the tops of tall, thick-foliaged trees and so are not easy to watch. The call is a very characteristic, sharp, finch-like, double '*chink, chink*'. A noticeable field characteristic is the width of the tail which is cut very square at the tip. They feed largely on berries often in company with *P. gularis* and *I. icterica*. I have only found the nest once, on 13 March. It was in a shady ravine in a plant of the *Strobilanthes* which formed the undergrowth beneath the tall evergreen forest. It was a rough, shallow cup of dead grass and rootlets lined with the latter, balanced on a leaf and bound to the main stem with cobweb so loosely that it looked as if it would overbalance at any minute. The solitary hardset egg, though of bulbul type, was quite distinctive and could not have been mistaken for that of any other species.

Brachypteryx major: The Rufous-bellied Shortwing.

So far only recorded, as far as Coorg is concerned, by Davison from the Brahmagiris on the extreme southern border of the Province. As however Sálim Ali has now found it on the Bababudans in N. Mysore, it probably occurs in small numbers at high elevations all along the Ghats though I have never come across it myself. In the Nilgiris it is common and I have found a number of nests. The birds very much resemble the White-bellied Flycatcher (*Muscicapula pallipes*) in habits. They haunt the interior of dark *sholas*, lurking in the undergrowth and seldom showing in the open. They have a sweet, but low, warbling song usually only heard at dusk. They are late breeders, most nests being found in May when the rains have broken. Rather surprisingly, considering their retiring nature, they frequently build in quite conspicuous places. A favourite site is a perpendicular cutting at the side of a path running through a *shola*. The nest is a large, loose mass of green moss wedged into a hollow in the bank, the shallow cup being lined with black rhizomes. Where the bank is moss-grown it is not easily seen, but when, as often happens, a bare earth face is chosen, it is visible at some distance. I have also found nests on a broken tree stump, and in a hollow in the stem of a big tree. The usual clutch is two.

Tarsiger brunnea : The Indian Blue-chat.

A common winter-migrant throughout Coorg, except, I think, in the Dry Zone. They arrive in a wave about the third week in October (dates over ten years Oct. 15th–27th), and for a few days their song may be heard in every thicket. It is a loud *'peep, peep'*, followed by a tumbled jumble of four or five other notes. It is uttered suddenly and surprisingly, and the bird then remains silent, save for an occasional low *'tck, tck'*, as it feeds. After a week or so numbers decrease presumably owing to the departure of birds wintering further south. The song is seldom heard after Christmas, and the birds remain silent until their departure. They are the most arrant skulkers, keeping to the ground in the heart of impenetrable thickets, and it is very hard even to catch a glimpse of them. They have a habit of flirting the tail like a Redstart.

Saxicola caprata : The Pied Bush-chat.

A widespread resident in Coorg. It is common in the Dry Zone and occurs throughout the Inter-Zone, where however it is more or less confined to paddy fields. It does not occur on the downs at high-elevations on the hills, a biotope so popular with the Nilgiri sub-species. It is a highly territorial bird throughout the year, each pair claiming an extensive range in which no trespassers are allowed, and there will seldom be more than one or two pairs in any one stretch of paddy fields. In the Dry Zone however where their range overlaps that of *Saxicoloides fulicata*, the two species may be found in occupation of the same area, despite both having similar habits and a highly developed sense of property.

Nesting begins about the end of March, a favourite site being a paddy-bund. The nest is tucked into some hole or crevice in a bank, and is a small cup of grass, lined with rootlets and hair. In front there is usually a small platform of dead leaves or grass. It is well-concealed but the position is given away by the birds. The hen slips off quietly at the first sign of danger, but both remain in the near vicinity scolding angrily until the intruder is past. The hen does all the nest-building, but both parents feed the young. The male has a sweet little song, uttered as he springs in the air and returns to his perch. I have heard them singing on bright moonlight nights, long before dawn. In display, the male crouches on the ground before his mate, singing loudly, wings and tail spread to expose to full advantage the white rump and wing patches. The food consists of insects caught by darting from a perch to the ground or into the air.

Saxicola torquata : The Stone-chat.

A fairly common winter migrant in the Mysore 'Maidan'. I have only once seen one in Coorg, in a paddy field near Fraserpet, in the Dry Zone.

Phoenicurus ochruros : The Indian Redstart.

A moderately common winter migrant in the Mysore 'Maidan'. I have seen them at Hunsur and Peripatnam and twice in the Coorg Dry Zone near the Mysore boundary. Open, stony, scrub jungle seems to be their favourite haunt.

Cyanosylvia svecica : The Bluethroat.

A fairly common winter migrant in Mysore where it is found along the reedy margins of half-dried tanks. They flit about among the reeds in a robin-like manner, but are silent, and I have never heard them utter a sound. The only record which I have for Coorg was a solitary seen on the banks of the Cauvery at Ramasamy Kanave in the Dry Zone, only a few yards from the Mysore border.

Saxicoloides fulicata: The Indian Robin.

Confined strictly to the driest part of the province at 2,500′/3,000′ where it is common in the thin, stony scrub jungle, and to a less extent in cultivation. It is very like the Bush-chat in habits. The birds remain paired and maintain their breeding territory throughout the year. They are more terrestrial than the Bush-chat, obtaining most of their food by hopping actively about on the ground with the long tail carried cocked high, and in moments of excitement, almost touching the back of the head. The song is a loud, short, sweet tangle of notes uttered from the ground or a low perch. Nesting begins as soon as the first spring showers give the vegetation a start. April and May are the principal breeding months. The nests are shallow cups of grass, lined with hair, and are placed in a variety of situations, but usually on the ground in a hollow in a bank or under a stone. I once found one in a thornbush, two feet up, which might have been mistaken for a bulbul's nest. They may be well-concealed or quite open. Nests I found at Secunderabad nearly all contained a piece of snakeskin in the construction, but I have not noticed this in Coorg. The cock shares in the work of feeding the chicks who are covered in blackish down. Three is the normal clutch.

Copsychus saularis: The Magpie Robin.

Common throughout most of Coorg, but does not occur on the Ghats or in evergreen forest, and is less common in the Dry Zone. Its favourite haunts are the '*bane*' lands round villages, open grazing among scattered trees which are constantly pollarded for firewood and provide numerous breeding sites in the decaying stubs. Being a highly territorial species it is rather thinly distributed, each pair occupying a considerable area. My garden used to constitute two territories. In the winter, both pairs came to feed amicably on the crumbs from my tea-table, but during the breeding season there was continual bickering. The cocks come into full song in January, being particularly vocal at dawn and dusk. In the presence of the female, they become quite possessed, bowing with the body quivering all over, the tail cocked right over the back, and singing as if their lungs would burst. On one occasion I saw two males locked in combat on the ground, while the female hopped round them singing lustily herself though not as loudly as the males do. Most of their food is obtained on the ground, and consists of insects. I have seen one attack and kill a young mouse.

In Coorg nesting takes place from February on until the rains, with occasional post-monsoon broods. In Ceylon, a pair which lived in the roof of my bungalow, raised a succession of at least three broods between April and August. When flown they all used to roost together on a limb of a cypress in the garden until the hen began to sit again, and it was only when the next brood were hatched that the last ones were finally driven out of the area.

Though the roof of a building may be chosen for a nesting site, the favour to position is a hole in a tree, either natural or the old boring of a woodpecker or barbet. It is usually at a considerable height from the ground, though I once found one in a fence post at four feet. The female does all the building, which merely consists of making an exiguous cup of rootlets and the midribs of dead leaves at the bottom of the hollow. There are usually three eggs. In the first juvenile plumage, the head and body are mottled brown, only the wings and tail showing the black and white of the adult. I have seen a completely albino specimen.

Copsychus malabarica: The Shama.

The range of this species is strictly limited to the bamboo facies of the deciduous forest belt. Here it is not uncommon though far from conspicuous as it is shy, usually silent, and decidedly crepuscular in habit. It has the sweetest voice of any bird in S. India, and it is only a pity that it makes such little use of it. The song may most often be heard at dusk. A few spasmodic fluty notes of singular richness, reminiscent of the best efforts of the Nightingale, are followed by several minutes' silence, and then repeated as the bird moves about in the interior of a bamboo clump. They feed mostly on the ground and among the undergrowth, seldom ascending high into the trees. They are in song from February onwards until well into the monsoon. I have never found a nest in Coorg, but once saw a pair with newly-flown young in June. As with *C. saularis*, the juveniles are mottled brown over the head and body but show the white rump, long black tail, and black and white wings of the adult. A nest I found in Assam in March was just like that of *C. saularis* in a hole in a tree stump, three feet from the ground in mixed forest. There were three young. When the nest was approached, the parents uttered a loud alarm note like the creaking of two branches rubbing together in a wind.

Turdus simillimus: The Blackbird.

A blackbird of some subspecies is resident on the Ghats from their summits down to about 4,000′. It is to be met with throughout the year in all the *sholas* and in the interior of evergreen forest, but is decidedly shy. I have only found old nests but like the Nilgiri bird they probably breed during the monsoon when their haunts are difficult of access. During the cold weather from October to March, blackbirds are common in the Inter-Zone specially in the coffee plantations in small parties. Whether these are migrants from the north or have merely moved downhill for the winter, I do not know, but I suspect the latter, as a male I shot was identified as subsp. *simillimus*. The winter flocks in the coffee feed on the ground among the dead leaves, flying up into the trees with a squawk of alarm if disturbed. I have seen them feeding on nectar from the blossoms of *Erythrina* trees.

On the Nilgiris the blackbird is very common, particularly so in small *sholas* and patches of cover along streams out on the open downs. Nesting begins in March, but is at its height after the onset of the rains, and the males are in song all through the monsoon. I found many nests there. A few were in evergreen shrubs and in these cases were substantial cups of moss, grass and lichen with an outer lining of mud and an inner one of grass. The great majority, however, were on ledges or cracks in banks where the earth had been laid bare by a slip, and in such sites were often mere cups of mud lined with grass with a little moss and lichen building up the front. The clutch is two, occasionally three.

In Ceylon the local subspecies is one of the few birds really at home in tea cultivation. The nests are usually well-concealed in the crowns of pollarded *Grevillea* trees, but may sometimes be found completely in the open in a fork in one of the sparsely-leaved *Erythrinas* grown for green manure.

Oreocincla dauma : The Nilgiri Thrush.

I have never seen this bird in Coorg myself though it may easily occur in the higher Ghat forests as it is such a shy dweller in the deepest woodland that it can easily be missed. On the other hand since the Mysore Survey only records it from the Billigiris, it may well be another of those high-level species which do not extend further north than those hills.

Geokichla wardi : The Pied Ground-thrush.

Never seen in Coorg, and only once in the Nilgiris, where I came across two males at 4,500′ in the Ochterlony Valley in forest on Feb. 28th.

Geokichla citrina cyanotus : The White-throated Ground-thrush.

This very well-marked resident race seems almost worthy of specific rank. It is a bird of medium elevations, and is numerous all through the Inter-Zone. It does not occur on the Ghats much above 4,000′, but extends through the deciduous forest belt in lessening numbers as the rainfall diminishes to its limit on the edge of the Dry Zone proper. Fairly open, well-wooded country suits it best, particularly coffee cultivation. It has a typical thrush song, first heard in February, loud, sweet and very variable. The bird sings from a perch well up in a tree. In fact the trivial name is a bad one, for though they obtain most of their food on the ground, they are otherwise largely arboreal. The male has a peculiar display, standing very erect and rigid on a bough beside his mate with the head bent stiffly and tucked into the breast feathers as he sings vigorously. Breeding starts late, seldom before the beginning of May by which time there has been a certain amount of rain, and the ground is softening, and earthworms are obtainable. It continues all through the monsoon up to September. The nests are substantial cups of moss, roots, and wood pulp, and often a certain amount of mud, with a lining of rootlets and leaf stems. They may be found in a variety of situations from thirty or forty feet up on a horizontal fork of a tall tree, to a crotch of a sapling or coffee bush within four feet of the ground. Wherever it is they prefer an open situation to one in the interior of a bush, and the lower nests are in consequence extremely conspicuous, and casualties are very high indeed. They often choose the *Erythrina lithosperma* saplings in young coffee clearings. One pair which I had under observation made unsuccessful attempts to breed four times in different saplings over an area of fifty square yards. I was able to follow one breeding cycle right through. The hen was extremely bold while brooding, the cock who did not seem to take his share in this work was much shyer. As soon as the young hatched, both parents fed them, largely on earthworms. It was noticeable that while the hen used to brood for a short spell after each feed, the cock merely fed the young, swallowed any faeces that were passed and went straight off. After the fifth day, the faeces were no longer eaten, but simply removed and dropped over the side of the nest. The incubation period was 13/14 days, and the young flew on the 12th day from hatching. In order to get some more photographs, I tethered one on the ground. The parents came to feed it and still removed the droppings though it was out of the nest.

After the beginning of October, the birds become very shy and are seldom seen, keeping to the ground and the undergrowth. Their numbers seem so reduced that I suspect that many migrate elsewhere during the winter months.

Monticola cinclorhyncha: The Blue-headed Rock-thrush.

A common winter migrant throughout the Inter-Zone of Coorg, particularly partial to coffee plantations. During its stay, it is to be found mostly in woodland of a fairly light nature, and is almost exclusively arboreal, living in the trees and finding most of its food there in the form of insects picked off the trunks and branches. It is of a solitary disposition as regards its own species but may sometimes be seen accompanying the mixed flocks. The average date of arrival over ten years has been Oct. 17th and it leaves about the end of March. I have never heard it singing, but it has a peculiar grating call note, seldom uttered.

Monticola solitaria: The Blue Rock-thrush.

A regular winter migrant but not nearly so numerous as the last. It will be found singly on any of the more craggy peaks of the Ghats up to the highest elevations, keeping to bare sheets of slab rock, where it feeds on insects caught in the crevices and under boulders. Occasionally a bird will adopt a building in otherwise unsuitable country. I have twice known one spend a whole winter on or in the close proximity of a coffee store with its adjacent cement drying floors, roosting under the eaves and taking shelter there when alarmed, and never going more than fifty yards away. I saw one of these dealing with a large centipede, three or four inches long. It was beating it on a stone to subdue it. They come in about the middle of October and leave in March.

Myiophoneus horsfieldii: The Whistling Thrush.

Common in the rain forest on the western slopes of the Ghats from sea-level up to 4,000′ or more. It occurs sparingly through the Inter-Zone wherever there are permanent, swift-running, rocky streams. It is essentially a waterside bird, and demands rocks, rapids and shady evergreen jungle. Slow, sandy or muddy rivers are of no use to it. It is sedentary, each pair occupying the same territory year after year, and building on the same site, often on the foundations of an old nest. Except in the breeding season they are shy and silent, hunting their food in the stream bed or in the undergrowth on the banks, the only sound uttered being a loud, single call note. From April onwards the males begin their sweet, loud song, a few rich notes wandering aimlessly up and down the scale for all the world like a boy whistling at random.

It is most often heard at dawn and dusk. Breeding does not start until the rains have well broken and the streams are coming down in spate. It goes on from May to August in the height of the monsoon. The nest is usually placed on some rocky ledge beside a waterfall or rapid, often in a spot continually soaked in spray. At times however they will nest in the rafters of a building, such as a mill or pulphouse on the river bank. The nest is a very bulky and solid cup of moss, often plastered in place with a foundation of mud especially when built on a sloping ledge. The lining is of roots, and the clutch numbers two or three. Two broods are often reared in the same nest without rebuilding.

Muscicapa parva: The Red-breasted Flycatcher.

A widely-spread and fairly numerous winter visitor over most of Coorg. I have noticed it most often in coffee cultivation but any fairly well-wooded country suits it. I have never seen one with even a suggestion of red on the breast. The most distinctive feature is the partially white outer tail feathers which are displayed when the bird spreads its tail and cocks it over its back, a constant habit while perching. It is a typical flycatcher in its ways, flying out from a perch to catch insects on the wing, or not infrequently on the ground, and constantly uttering its call note, a low '*tck, tck*'. It is seen singly and is a late arrival appearing in the last week of October.

Muscicapula pallipes: The White-bellied Blue Flycatcher.

Not uncommon at medium elevations up to 4,500′. It is typically a bird of dense evergreen forest, where it flits unobtrusively among the undergrowth and lower trees. Its quiet and retiring habits make it seem rarer than it is. It does not often come into cultivation but I have seen it on several occasions in the bamboo jungle of the Inter-Zone well out of its normal range. It is a sluggish little bird, seldom catching insects on the wing, but working through the thickets or dropping to the ground, constantly twisting and fanning its tail. The call note is a low, *tsk, tsk*, and the male has a sweet little song of a few notes uttered in a quiet, contemplative manner. I have not found the nest, but saw a pair feeding newly flown young at the end of June, so that it is probably a monsoon breeder.

Muscicapula rubeculoides: The Blue-throated Fly-catcher.

This species must occur in Coorg, as it is recorded as common by the Surveys both of Travancore and Mysore. I can only assume that as it is not noted in the Fauna as being a S. Indian bird, I was not on the look-out for it, and must have failed to distinguish it from *M. tickelliae*. In view of this and Sálim Ali's discovery of *M. superciliaris* in Mysore, any worker in the south will be well-advised to pay particular attention to the Blue Flycatchers, especially in winter, as it is possible that more of the N. Indian species migrate south than are suspected. On one occasion I had an excellent view of a typical *Muscicapula* which I was unable to place. The upper parts were dark, slatey blue, lores and cheeks black, a conspicuous but narrow white supercilium, throat, breast, and underparts rufous. The only species which at all appears to correspond is *M. hyperythra.*

Muscicapula tickelliae : Tickell's Blue Flycatcher.

Well distributed through Coorg at medium elevations. It does not, I think, ascend the hills above 4,000′. It is perhaps commonest in the Inter-Zone, both in the evergreen *sholas* and in coffee, and extends all through the Deciduous Forest and into the Dry Zone wherever there are clumps of large trees, such as mango topes and roadside banyan avenues. It is an arboreal species finding most of its food in the air or among the treetops, and seldom if ever comes to the ground. The breeding season is late—chiefly May and June. The males sing at intervals throughout most of the year, but in April and May their tinkling cadence is to be heard continuously. Most of the nests which I have seen were built in crevices formed by the twisting aerial roots of large parasitic fig trees. They are at any height from the ground, usually well up, and consist of a little loosely-packed pile of green moss filling up the hollow, with a shallow cup lined with black roots. I have one record of a nest in an old barbet hole.

Eumyias albicaudata : The Nilgiri Verditer Flycatcher.

I have never seen this species in Coorg. Since however Sálim Ali has obtained it both in the Billigiris and the Bababudans, it seems probable that it must exist in the province on the Coorg Ghats, though it is certainly very rare, as so distinctive a species would not be easily overlooked, and I have searched for it carefully.

On the Nilgiris where it abounds, breeding takes place in March/April. I have found many nests, in cracks in trees or among the hanging roots on an undercut bank at no great height from the ground. They are substantial cups of moss, lined if at all with black rhizomes. The *sholas* and well-wooded gardens and plantations are its favourite haunts at an elevation of 4,000′ and upwards. The song is a sweet little warble up and down the scale.

Eumyias thalassina: The Verditer Flycatcher.

A regular winter migrant and widely spread but in small numbers. I have seen them most often in coffee cultivation, where they occur singly or in pairs, keeping to the highest treetops and hawking flies in the usual flycatcher manner. They are late in arriving and leave early. I have not seen them before the last week of October, and often not until November, and they have left by early February. While in Coorg I have never heard them attempt to sing or even utter a call note.

Alseonax latirostris : The Brown Flycatcher.

Alseonax muttui : Layard's Flycatcher.

I am not certain of the respective distribution and status of these two species. *A. latirostris* undoubtedly occur throughout the year as a resident in small numbers as I have records of seeing it in every month, and I saw one feeding a newly flown juvenile on May 16th. Numbers, however, are greatly increased during the winter months, and it looks as if the small resident population is augmented by migration from the north. Some of these are probably *A. muttui* which I am not prepared to identify in the field. Coffee cultivation and light deciduous woodland, or the borders of evergreen *sholas* at medium elevations are their favourite haunts. They are nearly always seen singly, and are silent unobtrusive little birds, keeping to the treetops and catching flies on the wing.

Ochromela nigrorufa: The Black-and-Orange Flycatcher.

This is another montane species common in the Nilgiris whose furthest northern limit appears to be the Billigirirangan Hills. I have searched for it most carefully in the Coorg Ghats which appear to provide a perfectly suitable biotope but without success. In the Nilgiris it occurs freely from 4,500′ upwards. These birds are far from being typical flycatchers in habits. They frequent dark, evergreen *sholas* with a plentiful undergrowth of *Strobilanthes* or bamboo. Here they hop about among the undergrowth, seldom ascending far from the ground. They are silent birds and appear to have no song. The alarm note is the usual flycatcher '*zit, zit*', and they have another call note, a melancholy, low '*pee*'. They are tame and confiding, especially so at the nest. This is normally built low down in a shrub in the interior of a *shola* though I have found them just outside. It is almost indistinguishable from that of *Rhopocichla atriceps*, a ball of dead leaves, sometimes lined with grass, and sometimes quite unlined. The normal clutch is two. In the case of one pair which I watched building, the hen did all the collection of material and construction, but the male was in close attendance. A juvenile being fed by its parents had black wings, and russet rump and tail as in the adult, while the head, back, and underparts were speckled light and dark brown. May to July seems to be the normal nesting season.

Culicicapa ceylonensis: The Grey-headed Flycatcher.

The status of this bird in Coorg is rather obscure. It is presumably resident in the hill *sholas* but I have not been able to confirm breeding. They are certainly most numerous in the higher and wetter parts of the province, but are nowhere as common as in the Nilgiris. Elsewhere they are to be found at times throughout the Inter-Zone in evergreen jungle and coffee cultivation but I have not seen them in deciduous forests. At the lower elevations, they are wanderers, here today and gone to-morrow, though a pair may occupy a particular beat for some weeks together. They turn up at any time of year except between March and May, when they are presumably breeding in the hill forests. I have found nests in the Nilgiris and the Ceylon hills in May. They have been variously built on mossy tree trunks, a moss-grown boulder, or a bare earth cutting. The nest is a beautiful little half-cup of moss or lichen, felted with cobwebs and is usually composed of the materials of the background to which it is attached so that it is far from conspicuous. The sides of the cup are continued up for several inches to strengthen the support on the vertical face. All clutches I have seen have been three.

These little flycatchers are among the most active of their tribe, performing the most vigorous acrobatics in pursuit of their prey, and are constant members of the mixed flocks, acting, as Sálim Ali well puts it, as outriders, nipping up any particularly agile insects which escape the main body. They have a short, sweet, and surprisingly loud song, which is constantly uttered.

Tchitrea paradisi: The Paradise Flycatcher.

Apparently purely a winter migrant in this area. They begin to appear in early October, and I have records up till the end of April, but I have not seen them during the monsoon, nor have I been able to detect any suggestion of their breeding in the province. Throughout the winter months, they are to be found in small numbers, usually singletons, all over the country; in orchards and gardens in the Dry Zone, throughout the deciduous forest and coffee lands of the Inter-Zone, and well up the slopes of the Ghats. They prefer fairly dense, shady woodland, particularly along river banks and near water. All phases of plumage may be seen, though fully white males are not as common as females and juveniles, while males in the long-tailed red plumage are rare. It commonly associates with the mixed flocks until these break up at the onset of the breeding season.

Hypothymis azurea: The Black-naped Blue Flycatcher.

Quite common in the Inter-Zone. I have not seen it in the Dry Zone nor on the Ghats above 4,000′. They like shady, well-wooded country, particularly coffee cultivation. They are spritely, active birds, regular members of the mixed flocks. There is no song, but the constantly uttered, grating, double call-note is quite distinctive. They are always on the move, and when excited they have a habit of posturing and fanning the tail somewhat after the manner of *Rhipidura aureola* but not nearly to such an exaggerated degree.

Breeding starts rather late. I have found a nest in early March but one most commonly comes on them in late April and May. They are not hard to find if the birds are watched as the latter are by no means secretive. They are dainty, conical cups about 3½″ in depth by 2½″ in diameter, firmly bound to a vertical twig usually at the end of a pendant spray. I have found them on coffee bushes within two feet of the ground, but twelve to fifteen feet is more usual; often fully exposed on a bare bamboo. They are made of shreds of bark and cobweb, the exterior plastered with cobweb and cocoons until it is quite white. The hen does all the building, though the cock accompanies her closely. She sits in the incomplete nest, turning round and round, shaping the cup with her body while plastering the outside or weaving in the strong grass rim with her bill. The lining is of fine grass and the usual clutch three.

Rhipidura aureola: The White-browed Fantail Flycatcher.

Confined strictly to the Dry Zone and uncommon there. It is found in fairly open country in the neighbourhood of mango topes and banyan groves. It is apparently resident, but I have not found a nest. It is frequently seen singly, though sometimes keeping company with a flock of some other species such as *Turdoides*, *Dumetia*, *Chrysomma* or *Franklinia*.

It is an odd little bird, constantly pirouetting with extended wings, and the long tail spread in a wide fan. The song is a merry, little whistle of several notes, frequently uttered.

Lanius vittatus: The Bay-backed Shrike.

Restricted to the Dry Zone where it is found in small numbers in open, scrub-grown wasteland. It is undoubtedly resident, though I have not found the nest. A typical shrike in every way. From its behaviour, I suspect it is a late breeder, nesting in May and June after the early showers have brought on a growth of vegetation and insect life.

Lanius schach : The Grey-backed Shrike.

Well distributed throughout the more open parts of Coorg, but not, I think at high elevations, though in the Nilgiris it is common enough on the Plateau at 6,000′. In Coorg I have not seen it above 4,000′. In the Inter-Zone it will be found wherever open grazing land occurs, and in the Dry Zone in smaller numbers in the same country as the last species though, as Sálim Ali remarks, it tends to prefer a rather more wooded and orchard-like facies. Numbers are never large as it is highly territorial and each pair maintains a large hunting ground which is strictly preserved and occupied throughout the year.

In the Eastern Ghats Survey, Whistler suggests that some of the Coorg birds may be winter migrants, *L. s. erythronotus*, but in fact all our birds seem to be strictly resident, and I have seen no signs of a winter influx of visitors.

They are bold, fierce birds whose usual note is a harsh scream. In the breeding season however, the male has a sweet song. It is uttered in a low, meditative tone, and the bird is an excellent mimic introducing all sorts of other avian songs and calls.

The nest is usually placed in some isolated thorn bush well out in the open. Although in most cases in the heart of the bush, and well-protected by thorns, it is seldom at any considerable height from the ground, nor particularly well-concealed. As I have noticed however in the case of the European Red-backed Shrike, the materials used in the exterior of the stoutly-woven cup are of an untidy, ragged, weatherworn nature—small sticks, fragments of 'Old Man's Beard,' and dead leaves and grass—so that at a casual glance the nest looks like an old one. The lining consists of roots and grass. Four eggs form the normal clutch, sometimes five. Breeding does not begin much before mid-April, and most nests are found in May.

Lanius cristatus : The Brown Shrike.

One of the commonest winter migrants to Coorg. It occurs, always singly, all over the province in all types of country except the interior of evergreen forest. It is one of the earliest arrivals, and among the last to depart. The first come in during the second or third week of September, and most have left by the end of April, but I have seen stragglers in early May. A large proportion of the birds visiting us are juveniles with the lower plumage still faintly barred.

Hemipus picatus : The Black-backed Pied Shrike.

This little bird, in its habits, is much closer to the wood-shrikes and minivets than to the true shrikes. It is fairly common at medium elevations throughout most of the province. I have not noticed it above 4,000′, and on the Ghats it avoids heavy evergreen forest. It is most numerous in the lighter woodlands of the Inter-Zone coffee lands, and the adjoining deciduous forest, becoming scarce if not entirely absent in the Dry Zone. It is strictly arboreal, and haunts the treetops in small family parties, hawking insects actively on the wing like a flycatcher. It utters constantly a wheezy call-note of three or four syllables.

Breeding takes place mostly in March while the deciduous trees are still bare. The nest is built on a horizontal bough of a dead, or at any rate leafless, tree, usually at a great height from the ground. It is a tiny, very neatly-built, cup scarcely two inches in diameter, constructed of lichen and cobweb, and so woven and blended to the upper surface of the branch that from below it appears as a scarcely discernible knot in the wood. Small as is the bird, when sitting she overlaps the nest to such an extent that except for her rather hunched-up attitude, it is hard to realise that she is not perching normally. The camouflage extends to the young as they are covered in grey down of the same colour as the nest and bough, and except in the presence of their parents remain in a state of rigid stillness with beaks pointing vertically, and are practically invisible. The arrival of the old birds with food breaks the trance however, and I once saw a family roused to a great state of excitement and demonstrativeness by a sunbird which settled within a foot of them. The only nest which I have been able to reach was unusually low, 15′ up. The lining was of dried, fine grass. Both birds were taking part in the building, but it was deserted on completion before eggs were laid.

Tephrodornis gularis: The Malabar Wood–shrike.

A very common species in the wetter parts of the province at medium elevations. It is found everywhere in evergreen forest up to 4,000′ but preferably of a light type, in well-wooded park land, and especially in coffee cultivation. It occurs in lessening numbers through the deciduous forest belt, but its place is taken in the Dry Zone by the next species.

Through much of the year, particularly after the breeding season, they are found in large flocks, which make up a major proportion of the mixed hunting parties. At this time of the year they are very noisy, constantly uttering a loud call – '*chrrr, whit-tu, whit–tu, whit–tu*' or a harsh, querulous, single – '*chak*'. The flight is undulating with slow, sailing wingbeats. They are active enough at catching insects on the wing, but their special hunting grounds are the trunks and branches of tall trees. Their eyesight must be very sharp as they will sail down and pick an insect off a treetrunk fifty yards from their perch. They specialise in those of the largest size, big moths, locusts, and caterpillars which are hammered into subjection on a bough. In the evenings the flocks may be seen bathing in a pool or stream, swooping down and dipping on the wing as flycatchers and drongos do.

During the breeding season, they become shy and secretive, and the nests are extremely hard to find. The birds are paired by January but the main nesting period seems to be in mid-May. The few nests I have succeeded in finding have been in substantial horizontal forks of shade trees in coffee at twenty or thirty feet from the ground. They are shallow saucers about 4 inches in diameter, cemented with cobweb onto the upper surface of the bough where it widens into the fork, and practically nothing shows from below. The sides are built up for an inch and a half with felted lichen and cobwebs, and the lining is of grass and leaf-stems. Two eggs appears to be the normal clutch. The juveniles when they leave the nest are speckled grey all over the upper parts, particularly on the head, but very soon assume the adult plumage.

Tephrodornis pondicerianus : The Common Wood-shrike.

This species replaces the last in the Dry Zone. The two overlap on the borders of the deciduous forest, but the present species is much less a woodland bird than its larger relative and is quite at home in scrub jungle, provided there are a certain number of small trees. Their habits are very similar to the last, but they are not such noisy birds, and occur in smaller flocks, family parties of five or six being the rule. Breeding takes place in February and March, for they do not wait as do so many of the Dry Zone birds for the first showers. The nest is built, entirely exposed, on a horizontal branch of some leafless tree. They are small replicas of those of *T. gularis* and quite as hard to see unless given away by the owners. Three eggs seem the normal clutch. The young are clad in grey down, exactly the colour of the nest and the lichen-covered bough on which it is built. Both parents feed the young on insects, many of which are caught on the ground.

Pericrocotus flammeus : The Orange Minivet.

A common bird all over the Wet Zone in forested country, found in the hill *sholas* up to the tree limit, also through the wetter portion of the Inter-Zone, particularly in coffee land. They hardly enter the deciduous and are not found at all in the Dry Zone. They are very conspicuous birds, with their bright colouring, and spritely flycatcher-like ways. They roam through the tree-tops in small parties of half a dozen or so, in which scarlet males are in a minority. Common as they are, I have not been able to find a nest in Coorg, nor discover much about their breeding habits. They appear to flock practically throughout the year, and evidently nest high up among the tree-tops. I have seen nests blown down in a storm which were presumably attributable to this species, and in the Nilgiris saw one building in a tall Blue-gum in November. On the other hand a male shot in September was in post-nuptial moult, and I have records of males in transformation plumage from yellow to red in February and July so it looks as if the breeding season is a prolonged one.

Pericrocotus peregrinus : The Little Minivet.

The Little Minivet is common in the Dry Zone, and the adjoining deciduous forest belt, and is fairly common in the drier portion of the Inter-Zone in coffee land, but appears to be merely a wanderer there, appearing spasmodically. It is absent from the higher and wetter parts of the province. In the coffee shade trees, their habits resemble those of the last species. They range the tree-tops in company with other birds. On the other hand they are quite at home in the Dry Zone scrub, where the largest trees are little more than bushes. The breeding season appears to be mainly in March and April at which time the birds are seen in pairs which keep very close company. The only nest I have seen was just begun when found on April 22nd. Both birds were bringing lichen to a bough seven feet from the ground in a thorn bush in open scrub. The nest was apparently complete a week later, but never contained eggs. It was a beautifully neat, very deep little cup of flakes of lichen and bark bound with cobwebs to the upper surface of the branch, and lined with rootlets. The walls though firm and strongly woven were extremely thin. Although not quite so well camouflaged as the nests of *Hemipus* and *Tephrodornis*, it was by no means noticeable even at a range of a few feet, though quite unconcealed by foliage.

Lalage sykesi: The Black-headed Cuckoo-shrike.

A fairly common resident in the Dry Zone, both in cultivated areas and scrub jungle. Over the rest of Coorg, it seems a regular winter visitor, arriving about the second week of October, and leaving in March, and spreading all over the province up to considerable elevations on the Ghats. Even in its winter haunts, however, it is a bird of fairly open country with scattered trees, avoiding continuous forest and even heavily wooded cultivation such as coffee under shade. It is usually seen singly, and is a quiet bird. I cannot recollect hearing even a call-note. It works the upper branches of trees and tall bushes for insects, flying out to catch prey escaping on the wing. The only nest I have found was in the Dry Zone in a small, isolated tree twenty feet high in open scrub-grown grazing land on June 7th. The foliage was thin and the nest, though small, was in a bare fork of two twigs about a foot from the top and was not inconspicuous. It was a shallow saucer about 2½″ in diameter and was made of dry grasses, lightly bound with cobweb, forming a compact and firm structure, but lacking the finish of the nests of the minivets and wood-shrikes. It contained one well-grown chick and an addled egg.

Coracina novaehollandiae [macei] ; The Large Grey Cuckoo-shrike.

A wandering species found in small numbers all through the deciduous forest belt, the adjoining parts of the Inter-Zone, and the better wooded portions of the Dry Zone. They are usually seen in pairs or small parties, and seldom remain in one locality for more than a day or two. They keep to tall trees, playing follow-my-leader from one to another with a swooping, undulatory flight, and are extremely noisy, constantly uttering loud, querulous screams. The only nest I have seen was found at the end of January. It was sixty feet up in a huge *Bombax* tree on a fireline in the deciduous forest. It was built in a horizontal fork of an outlying branch, and was quite inaccessible. It appeared to be a small cobweb-covered hammock rather after the drongo pattern.

Artamus fuscus; The Ashy Swallow-shrike.

A very local species, but common where it occurs. Confined to the deciduous biotope of the Inter and Dry Zones. It is most commonly seen in teak and sandal clearings in deciduous forest reserves, where isolated dead trees provide suitable perches and nesting sites. In habits it closely resembles the bee-eaters. Numbers may be seen perched, huddled together, flying out to capture their insect prey which is invariably taken on the wing, and like bee-eaters they often soar for considerable periods at great heights from the ground. They are particularly active at sunset, especially when a flight of termites is emerging. They are bold birds, and chase with harsh cries any hawk or other raptor which appears in the vicinity. The only nest I have knowledge of, was being built on April 15th, in a hollow on the upper surface of a main bough of a dead tree, 40′ up and quite inaccessible, in a sandal clearing. Both birds were very busy bringing bits of grass, but one, presumably the female, appeared to be doing all the actual construction, her mate passing over the materials as he brought them. They were very noisy at this time, uttering loud, querulous cries.

Dicrurus macrocercus: The Black Drongo.

Very numerous throughout the province during the cold weather except in dense forest and on the higher hill tops. They arrive in October and leave by the middle of March. Where our birds breed I do not know as they are not found in the Dry Zone in the nesting season, nor in the adjacent parts of the Mysore Maidan.

They are about the last of the diurnal birds to go to roost, and a familiar spectacle on a cold weather evening is to see numbers, each perched on the topmost twig of some commanding tree, flying up vertically at frequent intervals to snatch some crepuscular insect outlined against the afterglow, and diving back with closed wings to their perch. Like all drongos, this bird bathes on the wing, plunging down to the surface of a pool or stream, dipping, and returning to a perch to shake off the drops and preen.

Dicrurus longicaudatus: The Grey Drongo.

Similar in habits and status to the last species, arriving and leaving about the same time. The two species being so alike, I have found it difficult to discover any outstanding difference in their distribution or mode of life. Their range is more or less coincident, but the Grey Drongo appears to be a bird of more forested country than its congener. Both birds are regular attendants at the nectar feasts provided by flowering trees.

Dicrurus coerulescens: The White-bellied Drongo.

A resident species confined to the eastern borders of the deciduous forest belt and the adjoining better-wooded portions of the Dry Zone. Forest clearings and scrub jungle with a fair growth of large trees are its favourite haunts. Sálim Ali particularises bamboo facies, but while this is popular, it is in my experience nowise essential. It is widely distributed but is never numerous, each pair maintaining a wide territory. It is a typical drongo in all respects, bold, conspicuous, and aggressive, resembling the last two species in calls and habit.

Nesting begins in the latter half of April at which time unless there have been unusually early rains, the trees are completely leafless and the whole country bare and burnt over. The nests I have seen have been built in horizontal forks of isolated trees at heights of 15 to 25 feet. They are usually well out towards the tip of a bough, but the fork chosen is a substantial one, and the nest, which is a shallow, firmly-woven saucer of grass and bark shreds, is wedged into it, but is not bound on with cobweb, of which little is used. The normal clutch is of three eggs. Both birds feed the young. Being fully exposed to the hot weather sun, one of the pair spends most of the time brooding the chicks while they are still naked, while the other does the foraging.

Chaptia aenea: The Bronzed Drongo.

One of the most familiar resident birds of the Inter-Zone. It avoids extensive stretches of evergreen forest and is not found in the higher or wetter parts of the province, and it is also absent from the Dry Zone, though common in the deciduous forest especially in teak and sandal clearings. But undoubtedly its favourite haunts are the light woodlands shading coffee and cardamom plantations. It is a typical little drongo, noisy and demonstrative, with a great variety of calls, many strongly imitative. One common alarm note is very like the scream of the shikra. Pairs keep together throughout the year, each maintaining a permanent territory and breeding in the same vicinity season after season. They are strictly arboreal, and never leave the shelter of the woods, and will not be seen perching on the ground in the open or on a cow's back as the Black Drongo does. Breeding starts in March and continues till May, but I think only one brood is reared though the birds will build a second time if the first nest is destroyed. They are very loath to desert. I knew of one bird which continued to sit after one of the eggs had been broken in the nest. Another, after being robbed, laid again in the same nest shortly afterwards.

The nests are mostly built at a moderate height only, from 12 to 25 feet. The usual site is a horizontal fork in the terminal twigs of a lateral branch of a sapling or small tree growing among others of larger size. Tari (*Terminalia belerica*) is a very favourite species. It is leafless during the breeding season and the nests are in no way concealed. Nevertheless, and though the birds are far from shy, they are not at all conspicuous, being small, shallow hammocks of fragments of inner bark, felted and cemented on the outside with cobwebs until they are nearly white in colour. The lining is of grass. Both birds take part in building. While applying the cobweb, the bird sits in the nest, turning round and round, apparently smoothing the exterior with its chin. Unlike the last species, the nest is actually slung under the fork not built on top of it. Three eggs are the usual clutch. The young are driven out of the breeding area by June, the old birds remaining throughout the monsoon silent and subdued, being then in full moult. Specimens with half-grown outer tail feathers are commonly seen in July.

Chibia hottentota: The Hair-crested Drongo.

A rather mysterious bird whose status I have been unable to determine. They are decidedly uncommon, but I have records of them from Pollibetta in S. Coorg, and Somwarpet in N. Coorg, both in the Inter-Zone. One or two are seen every year for a few days between November and March and then disappear. They seem to be entirely dependent on the nectar feasts provided by flowering *Bombax*, *Erythrina* or *Acrocarpus*, and only on one occasion have I seen one anywhere except among the hosts of drongos, bulbuls, mynahs, grackles and other birds which visit these trees in the flowering season. They are silent birds and extremely shy but their size and peculiar square-cut tails, curled up at the outer edges like a Blackcock's are very distinctive. The trees they frequent are of the largest size, and as these giants are nowhere very numerous, it seems as if the birds must wander widely in search of their favourite food. Where they breed or how they subsist when the blossoming season is over is an unsolved problem.

Strangely enough I have found this species to have entirely different habits at the other end of India, in Assam. There it occupies much the ecological niche which *Dissemurus paradiseus* holds in Coorg, being common in shaded tea gardens and light deciduous forest, and bold, tame and familiar, whereas *D. paradiseus* in Assam is a shy bird of the deep forest.

Dissemurus paradiseus: The Racket-tailed Drongo.

The range of this species coincides almost exactly with that of *Chaptia aenea*. It is a forest drongo, and is never seen outside continuous woodland, but on the other hand avoids the depths of dense jungle. It occurs on the outskirts and in clearings in the Wet Zone evergreen from the lowest elevations up to 4,000′, avoids the higher hills, but turns up again in great numbers in the Inter-Zone in the coffee and cardamom plantations. It extends into the border of the deciduous forest belt but gets scarcer as the country becomes drier and is absent from the Dry Zone.

The Racket-tailed Drongo and the Tree-pie are the chieftains of the coffee avifauna. Bold, bullying, and aggressive, they are masters and leaders of the mixed flocks, both in foraging and in mobbing attacks on any owls or hawks which venture into their domain. Their food consists of insects of all sorts up to the largest size, and I would not put it beyond them to attack nestlings, or small, weak birds. On two occasions I have seen one pounce on a particularly large sphingid larva and carry it off in its claws, a raptorial action I have seen used by no other passerine bird.

I have previously remarked on the apparent association between this bird and *Dendrocitta vagabunda*. It certainly seems to be something more than a simple case of common habitat and similar tastes in food. I have several times found the nests of the two very close together, once in adjoining trees, and have seen a pair of Racket-tailed Drongos feeding four newly-fledged young who were perched within a few feet of four young Tree-pies of similar age, also busily attended by their parents without the slightest friction between the two families. Both species are territorial and only one pair of drongos and one of tree-pies will be found in any one particular area.

Nesting begins in early April and only one brood seems to be raised. Their nesting habits differ considerably from those of the smaller drongos. The tree chosen is one in full leaf, favourite species being Atti (*Ficus glomerata*) and Beeti (*Dalbergia latifolia*). It is usually a tall sapling growing among larger trees, and the nest is either in the topmost twigs or towards the end of a lateral branch, seldom less than twenty feet from the ground. It is a hammock of bark and grass firmly slung to the twigs of a horizontal fork, but unlined and so loosely woven that the eggs can be seen through the bottom. No cobweb is used in the construction. The sitting bird is shy and silent, slipping unobtrusively off the nest at the first sign of alarm, but her mate who remains on guard at a safe distance is as noisy as usual. They are very faithful to their chosen breeding sites. I have records of nests for four consecutive years in a particular tree. Three eggs is the normal clutch, but as mentioned above I have seen four young being fed. The young on leaving the nest have short tails but the rackets are fully grown by mid-June. The old birds go into moult in July and August and lose their rackets at this time. The new ones grow from the quill in their final form—an inch or more of normal feather, and then six inches of bare shaft with the webbing reduced to a mere vestige. There seems to be no sign that the birds trim off the webs themselves as the S. American motmots are said to do.

The Racket-tailed Drongo is the noisiest of a noisy family. Their range of calls both harsh and pleasing is extraordinary, and they are remarkable mimics. In fact in their haunts any unusual and unfamiliar bird note of any considerable volume that may be heard is likely to be found to emanate from one of them.

Acrocephalus stentoreus: The Indian Great Reed-Warbler.

According to the Eastern Ghats Survey, there are two specimens from Coorg in the B. M. I can only claim sight records which are not reliable in the case of the warblers, but as far as I have been able to determine, this bird is a regular winter migrant to Coorg in rather small numbers turning up almost anywhere but chiefly in open country with plenty of scrub and long grass often at a considerable distance from water.

Acrocephalus dumetorum: Blyth's Reed-Warbler.

A very common winter visitor throughout most of the district. It avoids heavy forest and is most numerous in the more open parts of the Inter-Zone, where scattered lantana brakes provide convenient cover. It is an arrant skulker, very hard to flush but makes its presence known by its constantly uttered call, a sharp, single '*tchk*'.

Acrocephalus agricola: The Paddy-field Warbler.

Two specimens were collected by W. Davison in the Brahmagiris, but I have not come on it myself.

Orthotomus sutorius: The Tailor Bird.

I have only noted this species in the Inter-Zone and the lower slopes of the Ghats where it is common. It avoids heavy forest, and is definitely scarce in the Dry Zone scrub if it occurs at all. Cultivation, gardens, and open jungle are its normal habitats. It is everywhere resident, breeding mostly during the monsoon when the herbaceous growth it requires for nesting is at its maximum. At this time the birds are very vocal, and their loud-'*chu-bit, chu-bit, chu-bit*' resounds all day long, a call of astonishing volume for so small a creature. Normally quiet and skulking mouse-like among the the undergrowth, under the stress of sexual excitement the cock climbs to an outstanding twig and pours out his feelings, his whole body vibrating with the effort, his tail cocked till it nearly touches his back, and the feathers of his throat parting to show their dark bases which gives him the appearance of having a black gorget.

The nest may be built into one large or several smaller leaves. The site chosen is in some soft-leaved herb and is seldom more than three feet from the ground. The leaf or leaves are sewn into a bag with thread made of vegetable down. One continuous thread may serve for several stitches. The ends do not appear to be knotted but flock out naturally and hold themselves in place. The upper portion of the leaf nearest the stem arches over and protects the aperture which faces into the interior of the shrub. The true nest is built inside the leaf container, and consists of a soft cup of green moss, feathers, spiders' egg bags, bast, and vegetable floss. The rim is strongly reinforced with bark fibre. When built near houses or in pot plants on a verandah, as is often the case, all sorts of unusual materials such as bits of string, wool, or cotton may be used. Three eggs are the usual clutch. The hen when disturbed slips off quietly until she is at a safe distance when she demonstrates loudly. After the young have flown the families often join up with the mixed flocks.

Cisticola exilis : The Red-headed Fantail Warbler.

This bird has been recorded from the Brahmagiris in S. Coorg. A small, dark warbler, which I believe is this species, occurs somewhat scarely all along the line of the Ghats. I have only seen it at high elevations of 5,000′ or over, where it lives right in the open among the foot-high dwarf *Strobilanthes* which covers the hilltops above the tree-line in a continuous carpet in many places. The little bird bobs up under one's feet like a tiny quail, slips a dozen yards with a weak, fluttering flight, and disappears into the *Strobilanthes* again, and is almost impossible to flush a second time.

Cisticola juncidis : The Streaked Fantail Warbler.

There are specimens from Coorg in the British Museum. In my original Notes on the Birds of Coorg (*JBNHS* May 31, '29) I recorded this species as very common. In the light of maturer experience, and the knowledge of the danger of claiming definite records of the warblers from mere sight observations, I must retract this, and cannot affirm that I have ever unmistakably identified this bird in Coorg.

Franklinia gracilis : Franklin's Wren-warbler.

A regular and fairly numerous resident in the Dry Zone scrub, where in the off season small parties roam through the lantana brakes often in company with *Dumetia albogularis.* I have only seen them in the Inter-Zone and the deciduous forest in July and August during the height of the monsoon. At this time of year, the breeding season, they are particularly noisy and conspicuous and I may have overlooked them at other periods. I have not found the nest in Coorg, but came across several in the Ochterloney Valley of the Nilgiri-Wynaad, where they are very common in the long elephant grass, covering wide stretches of land once cleared for coffee, but long abandoned. They were of two types, but were all built in large-leaved herbaceous plants growing in the open among long grass. One form was a cup of fine grass flower-heads, lined with still finer grass stems, slung all round the rim by threads of cobwebs to the under-side of a leaf which formed a lid, leaving a small entrance where the leaf-stalk joined the stem of the plant. The others were just like tailor-birds nests. The two sides and the end of a large leaf were sewn into a bag, and the nest proper built inside. The clutches I found were in each case threes.

Phylloscopus spp.

Several species of Leaf Warblers are very numerous as winter visitors in Coorg, but not having shot specimens, I am not prepared to attempt to identify them.

Prinia sylvatica: The Jungle Wren-warbler.

A Wren-warbler, almost certainly this species, occurs in the Dry Zone where its habitat seems to be restricted to the stony, uncultivated ridges sparsely grown with grass and scrub which are a feature of the area. A nest I found on August 19th was built in a tiny isolated thorn bush, a foot high. In the middle of this was a little domed purse, roughly egg-shaped, loosely made of coarse, broad-leaved grass lined with finer grass. The two fresh eggs were whitish in ground colour, well-marked all over with spots and blotches of reddish brown and grey.

Prinia socialis: The Ashy Wren-warbler.

Considering what a familiar and common little bird this is in the Nilgiris, it is rather remarkable that in Coorg it appears to be extremely rare. Being one of the few warblers easily recognisable in the field, I do not think I am likely to have overlooked it. My only record is from a vegetable garden on the outskirts of Hebbale, a village in the Dry Zone.

Prinia inornata : The Nilgiri Wren-warbler.

A small wren-warbler which I suspect is this species is common all through the Inter-Zone and the lower slopes of the Ghats wherever paddy cultivation occurs. It frequents growing paddy, and the long grass of the bunds, and is probably a late monsoon breeder when the crop has reached its full height, as it is most conspicuous and noisy at that time. I have not found the nest however.

Irena puella : The Fairy Bluebird.

The true home of this species is the evergreen rain forest of the Ghats from the lowest elevations up to about 3,500′ or a little higher. Here it is common, and may be considered one of the most typical inhabitants of this biotope. It occurs, however, as well all through the Inter-Zone wherever patches of evergreen jungle are found, and is a regular member of the avifauna of coffee plantations. It is more or less resident, but like most frugivorous species wanders a good deal according to the food supply. The various wild figs make up a large part of its diet, and it is very partial to the nectar of flowering trees. Pairs are usually seen and they are noisy birds. The male has an explosive, liquid, bubbling whistle of two notes—'*whit-tu, whit-tu, whit-tu.*' As it calls the tail is jerked sharply as if with the effort of forcing the air out of the lungs.

I have found nests from March till May. In the jungle they may be in any dense-foliaged evergreen, and they are hard to find, but in coffee plantations in nine cases out of ten they are in 'jak' (*Artocarpus integrifolia*) saplings, so much so that if a pair is suspected of breeding in an area, it is usually sufficient to search all the small jak trees in the neighbourhood to find the nest at once. It seems a *sine qua non* that the chosen tree should be a dense and shady one. The nests are built in a fork well in the interior from 15 to 20 feet up, though I once found one in a coffee bush at 5 feet. This however was quite exceptional. The hen does all the building, the cock accompanying her, calling loudly, and thus often giving the game away. The nest is very distinctive and cannot be mistaken for that of any other bird. It consists of a rough platform of straight dead twigs six or seven inches long and remarkably thick, often at least $\frac{1}{4}''$ in diameter. On this is spread a layer of green moss, and a scanty lining of rootlets and leaf-ribs, with sometimes a few *Albizzia* leaves plucked green. Two is the invariable clutch in my experience. Both birds feed the young which are clothed from the time of hatching in a thick coat of gray down.

Oriolus oriolus: The Indian Oriole.

A common winter migrant throughout the province up to about 4,000′, most numerous in the Inter-Zone, and scarce if at all present in the drier parts of the district. Females and young males come in about the end of October, but the mature males seem much later in arriving, and will seldom be seen before December. Even then they are considerably in the minority. They are always to be seen among the mixed flocks in the coffee plantations though their food is largely vegetable; the various wild figs and other fruit and berries. They are noisy birds, their principal notes being a harsh shriek like that of *Coracina novuehollandiae* and the mellow flute-like whistle which gives them their English name.

Oriolus chinensis: The Black-naped Oriole.

I have only once seen this bird, a solitary male in rather dull plumage in a coffee estate at Pollibetta, S. Coorg, on Feb. 7th. I was able to make a close and careful observation, and have little doubt of the correctness of the identification.

Oriolus xanthornus: The Black-headed Oriole.

A rather uncommon resident confined to the Dry Zone where it is found in the wilder and better wooded parts, and in the adjoining portions of the deciduous forest. They wander a good deal in the off-season, being frugivorous, and fruit-bearing trees scarce and widely scattered in their habitat. They are nearly always seen in pairs, and betray their presence by their frequently reiterated, melodious whistle, a note not unlike that of *O. oriolus* but with a distinctive 'timbre'.

The only two nests I have found were begun in the early part of April and completed by the middle of that month. They were both in small isolated trees, standing in 'maidans' in light, open forest. They were deep hammocks of strips of tow-like inner bark, the rim firmly bound to the underside of a horizontal fork of an outlying bough at a height of about ten feet. The lining was of grass, and in the only one in which eggs were laid, a clutch of two was incubated. The female did all the construction, the male accompanying her, calling constantly. They were far from shy, and were extremely noisy in the vicinity of the nest.

Gracula religiosa: The Southern Grackle.

A common species in the wetter parts of the province, occurring in evergreen forest from sea-level upwards, but most numerous in well-shaded coffee and cardamom plantations between 3/4,000′. They avoid open country and even deciduous forest unless there is a fair admixture of tall evergreens, and they are completely absent from the Dry Zone. They are frugivorous, living mainly on the various wild figs. When the 'Goni', (*Ficus mysorensis*) is in fruit, the widespreading branches festooned with orange-coloured figs attract swarms of birds among which this species with the barbets and green pigeons are the most numerous. They also visit flowering *Grevillea*, *Acrocarpus*, *Bombax* and *Erythrina* trees in great numbers. They seem more sedentary birds than most fruit-eaters and a good deal of insect food must be consumed, though they rarely if ever come to the ground. Small flocks are seen throughout the year and they are extremely noisy with a wide range of wheezes, chuckles, and whistles, some melodious, some the reverse. They are favourite cage-birds and can be taught to talk or whistle a tune as well as any parrot. The flight is direct and powerful, the wings making a distinct whirring sound.

The breeding season is in March and April. If suitable trees are available they breed colonially. They prefer above all others tall, soft-wooded species of the largest size, particularly *Albizzia* and *Erythrina indica*, springing up 40/50′ without a branch. In the main trunks of these they make their own excavations, large oval holes up to 6″ in vertical diameter at any height above 30′. Their work can always be recognised by the untidy, chewed appearance of the bark round the edge. Internally the cavity is capacious, about a foot deep by eight inches wide. There may or may not be a rough lining of rubbish. Several pairs use the same tree, and revert to it year after year, the trunk becoming peppered with borings. In the event of their favourite sites being unobtainable they will use dead trees that have gone soft and rotten or enlarge woodpecker holes in those which would otherwise have been too hard for them to work on.

Pastor roseus: The Rosy Pastor.

A regular winter visitor to Coorg, but very variable in numbers. In fact they may really be only birds of passage as they never remain for more than a day or two in any one locality. They are usually only seen between January and March, frequenting open cultivated country in small parties in company with flocks of other species of mynahs. The *Bombax* and *Erythrina* trees are in bloom at the time of their visits, and are the most likely places to find them, though I have seen them feeding on wild figs.

Sturnia malabarica: The White-headed Mynah.

One sub-species at any rate, probably the typical one, is a common resident, and it is almost certain that *S. m. blythii* occurs as well as a winter visitor, but not having shot specimens I cannot vouch for this. The White-headed Mynahs are mostly to be found in the Inter-Zone between 3,000′ and 4,000′. They are absent from the Dry Zone and avoid high altitudes and continuous forest. Fairly open but well-wooded cultivation, and coffee and cardamom plantations are their favourite habitat, particularly village grazing grounds which provide spaces of open sward and numerous large trees which are continually lopped for firewood and whose limbs are in consequence gnarled, twisted and full of holes—admirable nesting sites for mynahs and paroquets. They are arboreal birds and seldom come to the ground. While largely frugivorous they consume a good deal of insect food, which they obtain by searching the crannies of the bark of the upper limbs of tall trees. After the breeding season, they unite in family parties but mostly disappear during the worst rains returning in large numbers in September. The cold weather flocks are often large, and they patronise big communal roosts in company with *Aethiopsar fuscus* in reedbeds in tanks or isolated thickets of lantana. It is a most interesting sight on a December evening to see the flocks of various sizes coming in from every direction often evidently from a great distance. Each as it arrives is greeted with a chorus of chattering from those already there, and often the whole gathering will rise with a roar of wings, and circle round before settling again. A deafening uproar continues till well after dark. In the morning they do not wake until the sun is fully risen, and there is less tumult, each flock taking wing independently and setting off quietly and purposefully for their chosen feeding grounds.

Breeding takes place from February to May, and probably two broods are reared. Any suitable natural hole may be used, usually in a side branch of a big tree at a great height from the ground. Only once have I found one as low as ten feet. Old barbet and woodpecker holes are equally welcome, nor need they always be old, for I have seen a pair evict a couple of Yellow-throated Sparrows, and two others having a violent quarrel with a Green Barbet and a Yellow-naped Woodpecker respectively, out of which the mynahs must have come victorious as in both cases they were in possession on my next visit. The nest consists of a pad of straw, feathers, and assorted rubbish on which are laid the two or three pale blue eggs. A young bird found fallen from the nest in my garden when placed in a cage hung from the verandah eaves was fed by its parents or another pair with the greatest boldness.

Temenuchus pagodarum : The Brahminy Mynah.

Confined entirely to the Dry Zone, and the bordering portion of the deciduous forest. In this area it is common and the predominating member of the family. They like open scrub jungle provided there are plenty of large trees, and well-wooded cultivation. Though fond of fruit when obtainable, they find much of their food on the ground, hunting grasshoppers and attending on grazing cattle for the ticks which frequent them, though not as regularly as *A. tristis.* On the ground they walk and run actively with a very erect stance. In the off-season they roost communally with other species in reed-beds. Breeding takes place in April and May after the first rains. Any natural hole in a big tree suits them, and the nest is the usual mynah collection of old rubbish. They tend to breed communally if sufficient sites close together can be found.

Acridotheres tristis : The Common Mynah.

This mynah is restricted almost entirely to open, cultivated country. It is fairly common in the Dry Zone round villages, but is not found in the scrub jungle or deciduous forest. They wander up into the Inter-Zone up to 3,500′, but again are only seen in open grazing land and round villages, and avoid coffee cultivation and any continuous woodland. These wanderers are on the best of terms with their far more numerous cousins, *Aethiopsar fuscus*, and join their flocks and roosts freely. While fond of fruit and nectar when obtainable, the bulk of their food is found on the ground and they are constant attendants on grazing cattle for the ticks and flies which infest them and the grasshoppers and other insects which they kick up. I have no data on the breeding of this mynah, but as far as I can make out those which visit the Inter-Zone are merely winter migrants returning to the Dry Zone to nest. My remarks under this species in my original Notes on the

Birds of Coorg should in fact refer to *A. fuscus* and not the present bird.

Aethiopsar fuscus: The Jungle Mynah.

Exceedingly common all through the Inter and Wet Zones wherever there is cultivation, but absent from the highest hills and all continuous evergreen forest. They occur in smaller numbers through the deciduous forest, turning up in clearings and plantations and are not uncommon in the scrub jungle and light woodland of the Dry Zone. In habits they closely resemble *A. tristis*, and the two are generally so similar that there seems very little justification for assigning them to separate genera.

They are catholic in their feeding tastes, taking all sorts of fruit, berries and insects, as well as nectar. Round habitations they are almost as arrant scavengers as the crows. Though to a great extent social while feeding, they tend to spread out in pairs over a wide area, assembling in flocks in the evening to fly to a common roost often at a considerable distance.

This is the only species which I have seen indulging in the peculiar habit of 'anting'. Two birds were watched sitting on the ground in a most unusual attitude, leaning back on their outspread tails with the wings half open, and picking up small black ants and applying them to their axillae.

Breeding extends from March till June with its peak in April and May. Any natural hole may be used at any height from six feet upwards. The favourite sites are undoubtedly the isolated pollarded trees on village grazing grounds where every suitable hole will be found to be occupied. Competition is keen and weaker species such as hoopoes are ruthlessly evicted. The nest is the usual pile of rubbish often in very large quantities if the hole is a big one. One bird deceived me. On several occasions I put her out of the nest but each time on feeling in could only detect lining. At last on removing some of this I found the eggs buried underneath and almost ready to hatch. Apparently she covered them each time before leaving. They are prolific birds; one raised a family of six in March, and there was a second brood of four in the same nest in the following May. Four or five is the normal clutch though six is not uncommon.

Ploceus philippinus: The Baya Weaver.

The Baya is found as a breeding bird in the Inter and Dry Zones, differing considerably in habits in the two biotopes. In the Inter-Zone it is entirely dependent on paddy cultivation. Numbers are small and colonies, which will be found on trees and bamboos on the borders of paddy fields, seldom exceed ten completed nests, and are often a mere half dozen or so. There is only one crop of paddy in Coorg except in a few small areas, and this is planted as soon as the rains break in June. The Bayas, who have been conspicuous by their absence all through the hot weather and early monsoon, appear about the beginning of September when the paddy is a foot high and at once begin breeding operations. They are very erratic in their visits. A colony in one stretch of fields one year is no indication that they will be there next season, or indeed anywhere within a considerable distance. Many weak colonies are started, and then abandoned. Presumably the isolated males that begin them fail to attract mates and go elsewhere. The only materials used in the nest are thin strips of paddy leaf. The bird nips the leaf to the required width and then flies off, tearing away a strip as it goes. The male does all the external building. As soon as the main body of the nest is completed, the female, if she approves of it, occupies it and begins to lay. I am not certain whether it is not she who adds the lumps of mud which are always found plastered onto the walls of the interior. The male continues the entrance tunnel while incubation proceeds and then goes on to build fresh nests. Many are never completed, and numbers in various stages will usually be found on the ground below, apparently cut down by the birds themselves for some reason. Breeding goes on until the end of October after which the males go into eclipse, and the birds unite in flocks and remain in the neighbourhood until the paddy is cut, feeding on the ripening grain. After January they leave the district, and the latest record I have is February 13th.

In the Dry Zone they are much more numerous and the colonies far stronger, 25 to 50 occupied nests being common. In this area paddy is not grown, and the birds breed on the edges of tanks and streams, nearly always in trees overhanging water, and make their nests of strips of reed or the prevailing grain, 'Ragi' (*Eleusine*). Breeding takes place earlier here, in June, July and August, the period of maximum rainfall. The grain crops are harvested in early September, and by mid-October the Bayas disappear. In some years when there is a good autumnal N. E. monsoon a recrudescence of breeding activity takes place in October/November. Two eggs are the normal clutch.

Ploceus manyar : The Streaked Weaver.

A common breeding bird in the Mysore maidan where every village has its tank. In Coorg however, there is such a small proportion of Dry Zone country of this type that there is only one tank of any size and not more than half a dozen which fulfil the necessary requirements of this bird. These consist of mainly strong stands of bulrushes growing in fairly deep water. I only know definitely of two breeding places and these are only used in years of good rainfall when there is plenty of water and the rushes make good growth. In such favourable seasons the colonies are large, fifty or sixty pairs at least. Most nests are built on the fringe of the beds, on the edge of open water. The tips of a number of reeds are firmly lashed together and woven into the top of the nest which lacks the suspensory neck of the Baya's. As in the case of that bird, the upper part of the nest is first completed and then the rim of the cup is woven forming a stirrup.[1] At this stage the nest looks like a helmet with chinstrap. Whereas in the Baya's nest a few lumps of mud are added at random internally, the Streaked Weaver, while the nest is still at this stage regularly plasters a definite band of mud half an inch wide all along the nape of the helmet. The cup is then added and the eggs laid. Sometimes no entrance tunnel at all is made. Usually however a short tunnel is built on during incubation. It is seldom more than six inches long, though I have seen one of a foot. Three is the usual clutch.

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[1] In the case of the Baya surely the 'stirrup' or 'chinstrap' is the first portion to be completed after the initial attachment to a twig, extensions from the two sides of which form the 'helmet'.—EDS.

As with the Baya, a Streaked Weaver colony at the height of the season presents an extremely busy and noisy scene. The males dash to and fro with strips of rush, or perch on the reed tops, fluttering their wings and displaying their golden crowns, chattering excitedly especially when any female appears.

The rushes are usually sufficiently tall by early July, and from then on until September nesting continues. After the season is over, the birds disappear, and like the Bayas their subsequent movements are unknown to me.

Munia malacca : The Black-headed Munia.

This bird is a constant associate of *Ploceus manyar*, and where one occurs the other is sure to be found. It is an essentially waterside species at any rate in the breeding season. I have never seen them in Coorg except when nesting, nor have I seen them in winter on the large Mysore tanks where the reeds remain throughout the year. They begin to arrive in their breeding quarters early in July, shortly after the Streaked Weavers, and building gets into its stride a fortnight later. The nests are built in bulrushes standing in water, but unlike the weavers are low down within a foot or so of water level. They are large, loose balls of bulrush leaves nine inches in diameter, woven round several reed stems. The lining consists of grass, and as with practically all species of munia, a fringe of flowering grass heads projects all round the entrance, in some particularly well-developed cases suggesting an embryo type of the weavers' entrance funnel. They breed colonially in company with the weavers though the nests are usually scattered over a wider area. One year there must have been at least fifty occupied nests with as many or more of *P. manyar* round one tank of about three acres in extent. By contrast with their neighbours the munias are quiet little birds though far from shy. I have seen them settle on weavers' nests and even go inside, but have been able to find no proof that they are in anyway parasitic. The full clutch is five or sometimes six, and as with many munias two birds may often be found incubating at once, so that it is possible that two hens may lay in the same nest. Breeding is usually over by mid-September and they disappear shortly after that time. They do not associate with the weavers while feeding, but join up in mixed flocks with other munia species, and feed on various weed seeds and often grain.

Uroloncha striata : The White-backed Munia.

The commonest munia in Coorg. They are most numerous in the Inter-Zone and in cultivated country and range up to 4,500′. They avoid continuous forest, but occur in maidans, in the deciduous jungle, and are found in small numbers in the Dry Zone. Except during the monsoon when they form large flocks they are inconspicuous little birds and I have not been able to work out their movements. A fair number must be permanently resident as I have found nests in almost every month of the year. They build in a variety of situations, but prefer gardens, orchards, and parkland, usually choosing a small isolated tree. The nest is placed among the upper or outer twigs at a height of from 6 to 20 feet, and is often quite conspicuous. It is a small, roughly built ball of coarse broad-leaved grass or bamboo leaves, lined with fine green grass whose flowering heads project round the entrance hole which is on one side. Five or six eggs are laid. The birds use the nests for roosting as soon as they are completed, and it seems likely that two females may lay in the same nest as I have on a number of occasions flushed three birds from a nest containing incubated eggs, and it is very common to find two, presumably cock and hen, sitting together. The whole family after fledging often return to roost in the nest and it is positively startling to find eight or nine of them exploding out of a nest which does not look big enough to hold half that number. Like all the family they appear to be almost exclusively seed-eaters, feeding on paddy and various other grass and weed seeds. The eggs can be distinguished from those of other munias by their long, pointed shape.

Uroloncha kelaarti: The Rufous-bellied Munia.

The range of this species more or less coincides with that of the last, but it prefers higher and wetter country, and I have never seen it in the Dry Zone, nor is it ever as numerous as the White-backed Munia. The two species frequently consort in mixed flocks to feed on paddy or wild grass seeds. They are only in evidence during the monsoon, and all occupied nests which I have seen have been found between June and August. They apparently sometimes build nests simply for roosting purposes as I have twice put a whole flock of eight or ten birds out of a nest which showed no signs of having been used for breeding. The nests are indistinguishable from those of the White-backed Munia and are built in similar situations. Broad-leaved grass is largely used and one may see a bird flying along with a piece as wide as itself and twice as long which practically hides it.

Uroloncha malabarica: The White-throated Munia.

I have only seen this species on a few occasions. Coorg is really out of their range but odd pairs stray into the Dry Zone from the adjacent Mysore Maidan, and I have found a nest in mid-June six feet up in a solitary thornbush on a rocky, scrub-grown ridge rising out of typical Dry Zone cultivation. It was the usual untidy munia ball of grass with the distinctive grass-flower entrance fringe.

Uroloncha punctulata: The Spotted Munia.

This munia which is the common species on the Nilgiri plateau at high elevations, strangely enough is not found anywhere in Coorg except in the Dry Zone where it is not uncommon in cultivated areas and wasteland grown with light scrub. I have not found the nest in Coorg, but those I have seen in the Nilgiris were quite typical munias nests built in small trees from 6 to 10 feet from the ground.

Amandava amandava: The Indian Red Munia.

An uncommon species which I have only met on a few occasions in the Dry Zone usually in small flocks in company with other munias. I saw a female carrying building material on Oct. 10th., but she disappeared in the long grass bordering a paddy field, and I was unable to find the nest. On the same date some years later I found a nest low down in a thorn bush within two feet of the ground which probably belonged to this species as I flushed one a few feet away, and the site was an unusual one for any of the other munias. The nest which was new but empty was a typical munia's in every way including the entrance fringe.

Carpodacus erythrinus: The Common Indian Rosefinch.

Common winter visitors. They arrive late, seldom appearing before November, and are found in flocks of twenty or thirty in fairly open country, grazing lands, cultivation, or the borders of jungle. They appear to be largely frugivorous and may often be seen feeding on nectar on flowering trees.

Gymnorhis xanthocollis: The Yellow-throated Sparrow.

Very common throughout the year in the Dry Zone. They are to be found in the Inter-Zone during the dry season and breed there, but appear to migrate during the monsoon. In the Dry Zone they are found in cultivated country, but they are much more jungle birds than *Passer domesticus*, and are equally at home in light, open forest, or scrub scattered with ancient trees whose gnarled and hollow limbs provide nesting sites. They occur through the deciduous forest in clearings and plantations. In the Inter-Zone they are most numerous in the open grazing grounds with their scattered trees, but also may be seen in thickly-shaded coffee plantations. In the Dry Zone they tend to breed colonially if suitable sites exist and the nests may be quite low down. In coffee plantations they nearly always choose an old barbet hole or natural hollow in an outlying limb of a dead tree, at a great height and usually quite inaccessible. The nest is a small pad of hair, feathers and grass. The site is given away by the male, who spends the greater part of the day sitting nearby, chirruping loudly and monotonously. The hen does all the building, the cock merely accompanying her in her search for material.

Passer domesticus: The Indian House Sparrow.

Occurs throughout Coorg but is nowhere numerous and is confined entirely to the towns and larger villages, and will rarely be seen more than a hundred yards away from human habitations. In habits it resembles the species the world over. Breeding appears to go on intermittently all the year round, and the nests are the usual untidy bundles of straw and feathers tucked into a hole in the thatch or under the eaves or on the rafters of some building.

Riparia rupestris: The Crag Martin.

I have seen this bird in large numbers in company with *R. concolor* hawking round the cliffs of Cottabetta, a hill some 5,500′ high in N. Coorg in March, and again at Mercara, 4,000′, in November. I take it that they are regular winter migrants to the higher crags and precipices of the Ghats.

Riparia concolor: The Dusky Crag Martin.

A regular resident on all the higher and rockier hills of the province, though nowhere in very large numbers in any one spot. They are quiet little birds, which spend their lives flitting up and down the face of some rock wall, uttering a soft, mouse-like cheep. They are not entirely confined to cliffs, however, as they are sometimes to be found in the neighbourhood of towns and villages such as Somwarpet and Mercara in the hillier parts of the country. Here they breed in temples and other large stone buildings, and they turn up again in the Dry Zone on high, isolated rock outcrops. They are early breeders, beginning about the end of January. They are not social in habits, the nests being built singly against a rock face, usually close under an overhanging ledge. They are shallow cups of mud, open at the top and lined copiously with feathers. In the case of one site which has been used to my knowledge for at least five years in succession, the owners seemed to have a predilection for green feathers which always constituted a major portion of the lining. Several broods are raised in a season, and as the mud cup is usually built in a spot well protected from the weather, it often survives from year to year with little repair, the lining being changed after each brood.

Hirundo rustica: The Eastern Swallow.

A common winter visitor in the Dry Zone, and also in the Inter-Zone wherever there is open country and paddy-field. From late September to March they outnumber all the other resident swallows put together.

Hirundo javanica: The Nilgiri House Swallow.

I am very doubtful about the occurrence of this bird in Coorg. My record, *vide* Eastern Ghats Survey, was almost certainly an error. The birds in question, in the light of subsequent experience, were probably *R. concolor*.

Hirundo daurica: The Striated Swallow.

A resident species though nowhere seen in large numbers. They are most numerous in the Dry Zone in cultivated country, but they are also found in the Inter-Zone in open areas where large tracts of paddy land occur, as round Virajpet and Ponnampet in S. Coorg. In the winter they flock and wander beyond their usual range in company with *H. rustica*, though these may possibly be a migrant northern subspecies. During the breeding season they are not sociable, and though one or two pairs may occasionally be found nesting in company, as a rule they build singly. For breeding purposes a horizontal stone slab on the underside of which they can cement their nests seems to be a *sine qua non*. Road culverts provide by far the commonest sites, followed by the sluiceways of tanks and the small stone-built Hindu temples which are frequent in the Dry Zone. Breeding seems to depend largely on the rainfall, as they are by no means waterside birds, and until water is obtainable they cannot start work. The day after the first shower of the year, be it in March, April, or May sees them furiously at work, collecting mud from the nearest puddle. They do not go far to fetch it, presumably because it would dry on the way and be of no use. The nests are hemispheres six inches in diameter with the entrance prolonged into a funnel, an inch and a half wide and six or seven inches long, and often by no means straight, running out at one side like a giant termites' gallery. The whole consists of mud firmly cemented to the stone, and there is a copious lining of feathers. Breeding goes on throughout the monsoon at intervals, the same nest being used again after repairs and relining. The only clutch record I have is three.

Hirundo smithii : The Wire-tailed Swallow.

This is essentially a waterside bird. They are found on all the larger rivers and tanks of the Province, from the rapid torrents running through forest-clad ravines at the foot of the Ghats only a few feet above sea-level to the broad stretches of the Cauvery flowing in the open, cultivated country of the Dry Zone. They spend their time hawking over the wider pools, and rarely leave the rivers except in the monsoon spates when they take to the flooded paddy-fields on the banks. Nesting begins in January and continues until the rivers rise in June or July. The nests are, in my experience, invariably built over water, seldom more than six feet from the surface, and often within a foot of it. Large numbers must be destroyed by sudden floods. The sites chosen are various ; overhanging rock ledges, the underside of fallen trees, culverts, sluices or boat-houses, but they are always in a position sheltered from above. They are small, shallow saucers of mud with a scanty lining of feathers and sometimes straw. Three eggs are laid, sometimes four. I do not know whether the male broods. He certainly helps to feed the young. The latter continue to use the nest even when they are strong on the wing and more or less independent of their parents, but after a week or so they are driven off when the latter begin to think about raising another brood. The old lining is removed and a fresh one added, but the mud cup is untouched though its exterior is often in a filthy condition from the droppings of the young birds. At least two and probably three broods are reared annually.

(*To be continued*)

NOTES ON BUTTERFLIES FROM NEPAL

BY

LT.-COL. F. M. BAILEY, C.I.E.

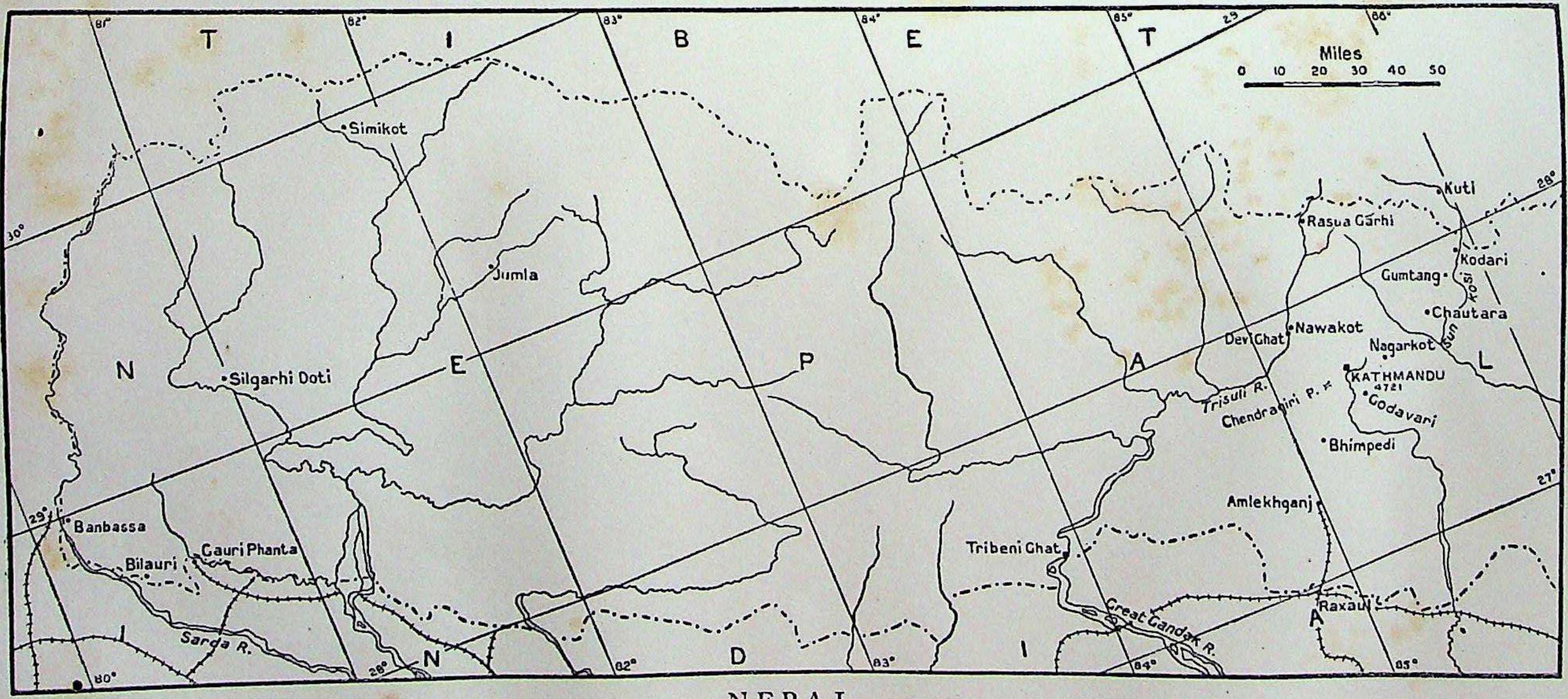
PART I

(*With a map and two plates*)

Nepal lies for five hundred miles along the southern face of the Himalayas, extending south of the foothills for a few miles into the plains. This extension is the Terai. In the localities given for species, and more especially for sub-species, in Evans's 'Identification of Indian Butterflies' we constantly come across 'Kashmir to Kumaon' for a western form, and 'Sikkim to Karens' or 'Dawnas' for the eastern. This is mainly a question of rainfall which necessarily affects vegetation and all forms of life. The annual rainfall of Sikkim in the east is about double that of parts of Kumaon in the west. Thus Nepal constitutes a strip of some five hundred miles dividing the western from the eastern forms, and, I hope, from this collection to find out where these changes occur. The differences of local races are in many cases very small, and it is often difficult to determine to which form the specimens in the intermediate area belong. As the butterflies of Nepal are little known, the result has been an extension of habitat of many forms from Kumaon eastwards and from Sikkim westwards. I have indicated this by an (E) or (W) as the case may be.

The saucer-shaped Nepal Valley is about fifteen to twenty miles in diameter. The general elevation above sea-level is about 4,300 ft. The rim of the saucer rises to 9,000 ft. The rivers outside this curious circular elevation flow at about 1,500 ft. The floor of the valley is densely cultivated with rice, maize and in winter barley and wheat. Potatoes and other vegetable crops are also grown. The valley is thickly populated. In the valley are some woods and wooded hillocks. The capital, Katmandu, several other towns and the British Embassy are also in the valley. The surrounding hills are covered in thick forest with areas of short turf and bushes. On these hills are two places, Kakni and Nagarkot, each about 6,000 ft. above sea-level, where the Prime Minister maintains guest houses which he kindly allowed the British Minister to occupy. The climate here was fresher than the damp heat of the valley, especially in late summer. In the south-east of the valley is a place called Godavari where H. H. The Prime Minister has a palace. Here the woods and streams were a relief from the flat valley although the altitude was very little higher. Several interesting species were found here among the gardens and rivulets.

This is the area to which the members of the British Legation were confined when this collection was made. The 'Valley' in the following pages refers to this area. There was one exception to this restriction of travel: the Minister was allowed to go to Devighat on the Trisuli River, a day's march from Katmandu outside the valley to the north, where there was mahseer fishing. The altitude was 1,500 ft. The journey to and from Raxaul, the railway station in India, also gave


T I B E T
Miles
0 10 20 30 40 50
81° 82° 83° 84° 85° 86°
30° 29° 28° 27°
80° 82° 83° 84° 85°
Simikot
Jumla
Silgarhi Doti
N E P A L
Kutl
Rasua Garhi
Kodari
Gumtang
Sun Kosi
Chautara
Nawakot
Devi Ghat
Nagarkot
KATHMANDU
4721
Trisuli R.
Chendragiri P.
Godavari
Bhimpedi
Amlekhganj
Tribeni Ghat
Raxaul
Great Gandak R.
Banbassa
Bilauri
Gauri Phanta
Sarda R.
I N D I A

NEPAL

(Showing the principal Localities where Butterflies were collected.)

पुस्तकालय

opportunities for collecting at lower elevations. Places on this road were: Chandragiri (on the rim of the saucer 7,700 ft.), Chitlang, Bhimpedi, and Amlekganj.

In addition to the above the British Minister was allowed to shoot in the Terai, the belt of land in the plains below 1,000 ft. in altitude running up to the foot of the mountains. This was extensively cultivated, but also contained much natural forest with tall grass especially in the stream beds, the haunt of wild elephants, rhinoceros, buffaloes and tigers besides deer and many other animals. The Terai was only visited in winter. These are the localities in which I was able to collect personally during the three years 1935 to 1938 in which I was in Nepal.

Besides these places in which I collected myself, I sent collectors to other parts of the country. For this purpose I trained two Nepalese boys, not only in collecting butterflies but also birds, plants and small mammals. In the summers of 1935 and 1937 these collectors visited the country north of Katmandu while in 1936 they were sent to western Nepal and visited the Tibetan frontier. They did not bring anything from the high Tibetan Plateau as the Tibetans would not let them collect there. A special purpose of sending them here was to obtain specimens of the Mountain Quail (*Ophrysia superciliosa*), a bird which had not been seen since 1876. They were not successful in this. I found that the collectors were unreliable in the use of an aneroid therefore no altitudes are given for specimens collected by them.

There are a few specimens in the British Museum labelled 'Nepal' but no indication as to who collected them. However, in the preface to Moore's 'Lepidoptera Indica', the author acknowledges specimens collected by Maj-Gen. G. Ramsay when he was Resident in Nepal from 1852 to 1867. Ramsay's notes on his collections were recorded in the *Proc. Zool. Soc.* in 1874, '77, '78 and '83. A large collection of butterflies was made by Major W. G. H. Gough; his list was published in Vol. 38 of the *Journal*. He records 162 species and sub-species, almost all of which were collected in the valley and on the surrounding hills. As he did not emphasize the extension of habitat I have included those in Gough's list when indicating an extension (E) and (W). A few specimens taken before 1934 are from the collection of Col. W. Smith who was Legation Surgeon.

All species have a reference number to Brigadier Evans's 'Identification of Indian Butterflies', 2nd. Revised Edition. Besides this a reference has also been given to Talbot's 'Fauna of British India' which was published after Evans's 'Identification'. This only deals with Papilionidae, Pieridae, (published in 1939), and Danaidae, Satyridae, Amathusiidae and Acraeidae (published in 1947). In the Hesperiidae a further reference is given to Evans's 'Catalogue of the Hesperiidae from Europe, Asia and Australia in the British Museum' 1949. Brigadier Evans has kindly looked over the list of Hesperiidae and checked the names.

PAPILIONIDÆ

1. **Troides helena cerberus** Fd.

Talbot F.B.I. 1c; Evans 1. 1.
Much less common than *Aeaeus*.
Katmandu, June to September.

2. **Troides aeacus aeacus** Fd.
Talbot F.B.I. 2; Evans 1.2.
Common in the Valley in May and June; particularly plentiful at Godavari in June.
Gui-ye, North Central Nepal 20–5–37.

3. **Polydorus aristolochiae aristolochiae** Fab.
Talbot F.B.I. 12a; Evans 2.10.
Katmandu, 4,300 ft. March and May.

4. **Polydorus latreillei latreillei** Donovan.
Talbot F.B.I. 14a; Evans 2.12.
Valley up to 5,500 ft. May to July.

5. **Polydorus philoxenus philoxenus** Gray.
Talbot F.B.I. 17a; Evans 2.15.
Valley, April to August.

6. **Polydorus dasarada ravana** M.
Talbot F.B.I. 18a; Evans 2.16.
Nepal Valley, May.
A few brought in from the north, in May 1935 and May 1937.

7. **Polydorus plutonius pembertoni** M.
Talbot F.B.I. 20a; Evans 2.18.
Three specimens: Valley, May 1937; Gui-ye, North Central Nepal 20–5–37; Nangang, West Nepal, 26–5–36.

8. **Chilasa agestor agestor** Gray.
Talbot F.B.I. 21a; Evans 3.1.
Rare—only two specimens; Katmandu 30–3–34 and 1–5–35.

9. **Chilasa epycides epycides** Hew.
Talbot F.B.I. 22a; Evans 3.2.
Valley, only in March and April.

10. **Chilasa clytia dissimilis** L.
Talbot F.B.I. 25a; Evans 3.5.
Morang, East Terai, 24-3-36.

11. **Papilio memnon agenor** L.
Talbot F.B.I. 27; Evans 4.2.
Valley, March to October, frequently at damp sand: Katmandu ♀ *agenor* form, Oct. 1933; Katmandu ♀ *alcanor* form, Oct. 1933; Devighat 1,500 ft. 25-10-35; Nangang, North Nepal 26-5-35; Kashiganj 7-8-35.

12. **Papilio bootes janaka** M.
Talbot F.B.I. 29.a; Evans 4.4.
Valley, up to 5,000 ft., April to June; Kodari, North Nepal, 21-5-37; Nangang 26-5-35.

13. **Papilio rhetenor rhetenor** Wd.

Talbot F.B.I. 30a; Evans 4.5.

Valley and surrounding hills to 7,000 ft. March to August; Nagarkot, 7,000 ft. 7-8-36. ♀

14. **Papilio protenor euprotenor** Fruh.

Talbot F.B.I. 31b; Evans 4.6.

Valley and surrounding hills to 7,000 ft. March to September.

Larvae found on *Zanthoxylum alatum* Roxb. (Rutaceae) at Nagarkot, 6,000 ft. Pupated in autumn and emerged at Katmandu on dates between 15th February and 11th March.

A pair were taken *in copula* at Sunderijal in the Valley on 4-7-36.

15. **Papilio polyctor ganesa** Db.

Talbot F.B.I. 35b; Evans A. 4.9.

Common on the hills above the Valley which rise to 7,000 ft.

The larvae were plentiful on *Zanthoxylum alatum* (Rutaceae) at Nagarkot between 5,000 and 7,000 ft.; they were brought down to Katmandu (4,300 ft.) where pupations of late autumn mostly emerged in April. There were three early emergences at the beginning of March. A few emerged in August and a single one which pupated on the 25th of August emerged the same year on the 5th of October.

Many pupae were destroyed by parasites.

16. **Papilio paris paris** L.

Talbot F.B.I. 36b; Evans. 4.10.

Valley 3,000 to 5,000 ft. April to September.

17. **Papilio arcturus arcturus** Wd.

Talbot F.B.I. 37b; Evans. 4.11.

Sundarijal, Valley 5,500 ft. 3-8-36; hill above Kakni, 7,500 ft. 15-9-37.

Not common. [Larvae in Kashmir were found on *Skimmia* (Rutaceae).]

18. **Papilio helenus helenus** L.

Talbot F.B.I. 45a; Evans 4.19.

Valley, March to October. One emerged at Katmandu on 23-3-38.

19. **Papilio chaon chaon** Wd.

Talbot F.B.I. 47a; Evans 4.21.

One specimen at Bhimpedi, about 1,000 ft. below the Valley.

20. **Papilio polytes romulus** Cr.

Talbot F.B.I. 51 a; Evans 4.25.

Common in the Valley from March to November; particularly plentiful in early April. Larvae feed on orange trees. Most females are of form *stichius* Hub. mimicking *P. aristolochiae*, but there are several of form *romulus* Cram. mimicking *P. hector*, a butterfly which was never found in the Valley.

21. **Papilio demoleus demoleus** L.

Talbot F.B.I. 54a ; Evans 4.27.

The commonest *Papilio* in the Valley where the larvae do appreciable damage to orange trees. This butterfly was seen every month of the year except January and February.

Autumn pupations emerged at the end of March. Pupae suffered very much from parasites.

22. **Papilio machaon emihippocrates** Verity.

Talbot F.B.I. 56e ; Evans 4.29.

A few were taken in the Valley and on the surrounding hills (4,300 to 7,000 ft.) Some at Devighat 1,500 ft.

Four larvae were found on fennel [*Foeniculum*, (Umbelliferae)], in the Legation garden at Katmandu. All these pupated on 15-11-36 and two emerged on 8-4-37 and one on 1-5-37. Several brought down from the Tibetan frontier were the short-tailed *ladakensis* M. (Kuti 6-6-37, Balwa 12-6-37 and 25-9-37.)

23. **Graphium euros sikkimica** Heron. (W)

Talbot F.B.I. 58b ; Evans 5.1.

Valley, March to early May, not common.

24. **Graphium nomius nomius** Esp.

Talbot F.B.I. 61a ; Evans 5.4.

Common on damp sand at Amlekganj below the Valley, 1,000 ft. 24-4-38. This is an extension of habitat westwards in the Himalayas.

25. **Graphium cloanthus cloanthus** Wd.

Talbot F.B.I. 64 ; Evans 6.1.

Common in the Valley. In company with *Teinopalpus imperialis* flies round isolated hilltops.

26. **Graphium sarpedon sarpedon** L.

Talbot F.B.I. 65b ; Evans 6.2.

Common in the Valley, March to October. Females were seen depositing eggs on 18-6-37 and 14-8-37. These last eggs hatched out on 19-8-37 and the butterflies emerged on 13-10-37, 6-3-38 and 9-3-38. In these specimens the green bar across the wings is of a light greenish yellow and lighter than in wild caught specimens. It would appear that the female never deposits more than one egg on a bush. It seems necessary for the female to wait and make a short flight between depositing each egg. I was able to get several eggs by pulling up the bush on which an egg had been laid and running down the pathway through the forest, when the butterfly would deposit another egg on the same bush in my hand and in this way I obtained several eggs.

27. **Graphium doson axion** Fd.

Talbot F.B.I. 66 c ; Evans 6.3.

One specimen in the eastern Terai on 26-3-36 at about 1,000 ft.

28. **Graphium bathycles chiron** Wallace.

Talbot F.B.I. 69 ; Evans 6.6.

Valley, March and April. Rare.

29. **Graphium agammemnon agammemnon** L.

Talbot F.B.I. 71a; Evans 6.8.

Valley, March to September. Larvae were found on Magnolia and the butterflies emerged between 23rd and 28th September 1935.

In Central India I found this butterfly depositing eggs on *Michelia champaca* (Magnoliaceae).

30. **Graphium gyas gyas** Wd. (W)

Talbot F.B.I. 75a; Evans 8.1.

Only two worn specimens taken at Godavari in the Valley on 29-4-36 and 3-10-37.

31. **Teinopalpus imperialis imperialis** Hope. (W)

Talbot F.B.I. 79a; Evans 9.

Locally fairly plentiful on Mahadeo Pokri Hill 7,400 ft. at Nagarkot above the Valley. Accounts of the habits of this splendid insect state that it flies round the tops of high trees. The hill of Mahadeo Pokri had been cleared of trees for survey purposes and in their places bushes up to ten feet high had grown. This had the effect of a high tree top. The male butterflies flew fast round this hill and descended to rest on the low bushes. Other butterflies flying with it were *Graphium cloanthus* and *Hestina nama.* Thinking that *Teinopalpus* did not occur west of Sikkim I at first thought this butterfly, when seen on the wing, was a torn specimen of *G. cloanthus*, when to my surprise it settled with great suddenness on a leaf in front of me and I was able to recognise and photograph it.

An account with photographs of this butterfly in Nepal was published in the *Journal of the Bengal Natural History Society*, Vol. XIV, No. 4, pp. 123 and 124.

At first these butterflies were very wild and flew away at my approach, flying round for a few minutes before returning to nearly the same spot. After being disturbed a few times they seemed to get tired of this and eventually I was even able to touch them without frightening them away.

32. **Parnassius hardwickei hardwickei** Gray.

Talbot F.B.I. 86a; Evans 13.4.

Many brought in by collectors, May to September.

PIERIDAE

33. **Leptosia nina nina** Fab.

Talbot F.B.I. 95; Evans 1.

Valley, 14-8-37. Rare.

Common in the western Terai, December and January.

34. **Pieris napi montana** Verity.

Talbot F.B.I. 137b; Evans 4.7.

A few specimens in June 1937 from Kuti and Chosang on the Tibetan side of the Nepal-Tibet border in the west.

35. **Pieris canidia indica** Evans.

Talbot F.B.I. 141b; Evans 4.10.

Common in the Valley and brought in from other parts of Nepal; also from the Terai in winter.

Pairs were taken *in copulae* on 16-3-35, 15-10-35, 1-11-37, and 1-12-27 Eggs were laid on garden stock on 1-3-35; these hatched on 11-3-35 but the larvae seemed unable to eat the thick leaves and all died.

The full grown larvae are green with fine white hairs on the tip of which are minute drops of a colourless liquid.

36. **Pieris brassicae nepalensis** Db.

Talbot F.B.I. 142; Evans 4.11.

Common in the Valley and throughout the country to which collectors were sent.

37. **Aporia agathon agathon** Gray.

Talbot F.B.I. 102d; Evans 5.5.

Very plentiful on the hills surrounding the Valley and the woods at Godavari and other places in the Valley. On 1-6-35 a female was seen depositing eggs on Holly Berberis (*B. asiatica*, Berberidaceae) in deep forest. No eggs were found on Berberis in open sunlight. Eggs were laid in batches. Eighty-eight were counted in one batch and most batches were about this size. Larvae hatched between the end of June and up to the 9th of July. The young larvae eat the centre of the leaves.

Specimens of *A. agathon caphusa* M. were brought in from western Nepal in May and June 1936.

38. **Delias agostina agostina** Hewitson.

Talbot F.B.I. 113; Evans 6.1.

One specimen at Katmandu, 4,500 ft. 15-4-34.

39. **Delias eucharis** Drury.

Talbot F.B.I. 114; Evans 6.3.

Only in the Terai.

40. **Delias hyparete indica** Wallace.

Talbot F.B.I. 115b; Evans 6.4.

One in the Valley and two brought in by collectors in July and November from the country north of the Valley.

41. **Delias belladonna horsfieldi** Gray.

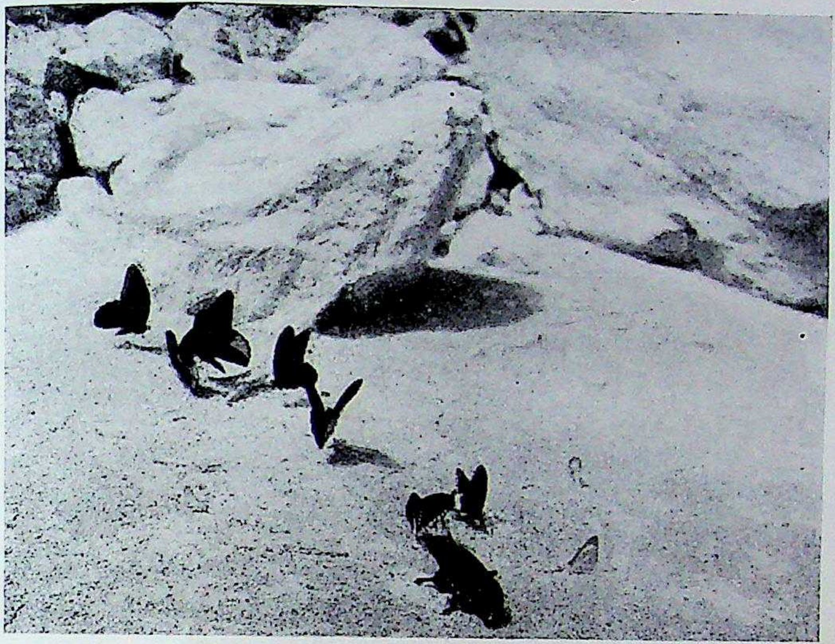
Talbot F.B.I. 109a; Evans 6.7.

Very plentiful in April and May in the Valley where it is found in great numbers at moisture. An autumn brood appears in August to November, but is not so plentiful.

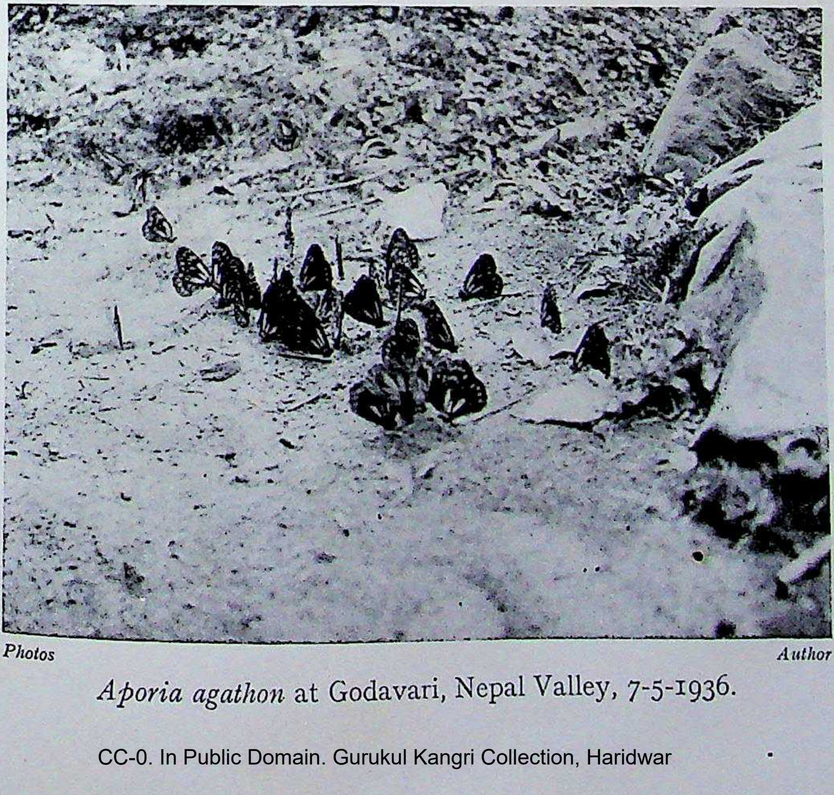
A pupa was found fastened to the upper side of Holly Berberis (*Berberis asiatica*). This emerged on 17-8-35.

42. **Delias sanaca sanaca** M.

Talbot F.B.I. 107; Evans 6.9.



Papilios on wet sand—*Papilio memnon agenor, polytes* and *paris* (or *ganesa* ?) can be recognized—also *Cepora nadina*.



Photos *Author*

Aporia agathon at Godavari, Nepal Valley, 7-5-1936.

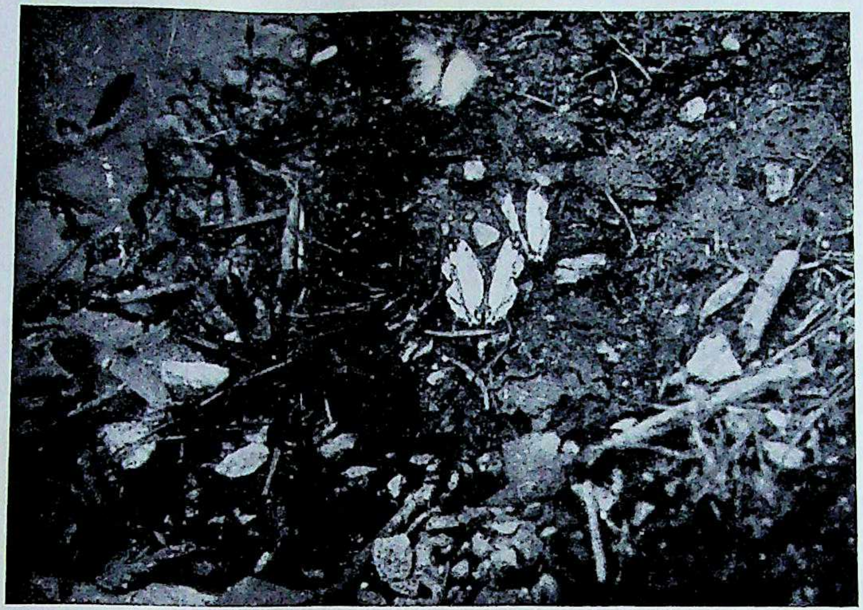


Photo Author

Cyrestis thyodamas at Godavari, Nepal Valley, 8-5-1937.

Two specimens from West Nepal (Pomo 15-6-36, Nilkirda 13-6-36) are *sanaca. sanaca*. One from Barai, West Nepal 14-6-36 approaches *sanaca confusa*. *D. sanaca oreas* is from North Nepal: Trisuli 1-6-35; Karai 19-5-35 and Kodari 1-6-37.

43. **Delias berinda boyleae** But.

Talbot F.B.I. 108a ; Evans. 6.10.

Common at Katmandu and Godaveri up to 5,000 ft. in May and a few in June. One at Nagarkot 6,000 ft. 7-6-37 and one at Kodari, North Nepal, 1-6-37.

44. **Delias descombesi descombesi** Boisduval.

Talbot F.B.I. 112 ; Evans 6.11.

Two specimens: Nagarkot 7,000 ft. 12-7-35; Katmandu 4,500 ft. 29-4-35.

45. **Delias aglaia aglaia** L.

Talbot F.B.I. 110a ; Evans 6.12.

Devighat 1,500 ft. 27-10-35 ; Kajuri 24-11-35 ; Galchi 5-11-36.

46. **Delias thysbe pyramus** Wallace.

Talbot F.B.I. 111a; Evans 6.13.

A few at Katmandu, March and August; Devighat 1,500 ft. 15-12-35; Bhimpedi 2,000 ft. 21–7–36.

47. **Anapheis aurota aurota** Fab.

Talbot F.B.I. 122b ; Evans 8.

Katmandu 3-5-37, 20-6-37 ; Nagarkot 7,500 ft. 14-6-37; Devighat 1,500 ft. 25-12-35.

48. **Cepora nerissa phryne** Fab.

Talbot F.B.I. 117a ; Evans 9.2.

Katmandu April, May and June. August specimens are *nerissa nerissa* Fab. A single specimen on 4-9-37 is dry-season form *copia* Wall. At lower elevations Amlekganj and Bhimpedi about 1,000 ft. this insect is commoner than further in the hills. A pair *in copula* at Chitlang 5,000 ft. 14-6-36.

49. **Cepora nadina nadina** Lucas.

Talbot F.B.I. 118c ; Evans 9.3.

Only obtained from the Terai. Two specimens at Tribeni on 12-1-36 are the dry-season form *ambā* Wall.

50. **Appias lalage** Doubleday.

Talbot F.B.I. 124a ; Evans 10.2.

Scarce. Nagarkot 7,000 ft. 6-6-37 ; Godavari 4,500 ft. 17-4-38.

51. **Appias lyncida eleonora** Boisduval.

Talbot F.B.I. 127c ; Evans 10.5.

A few at Katmandu, October and November. Godavari 8-10-36.

52. **Catopsilia crocale crocale** Cramer.

Talbot F.B.I. 165; Evans 11.1.

One female specimen from Katmandu 4,500 ft. form *jugurtha* Cram.

53. **Catopsilia pomona** Fab.

Talbot F.B.I. 166; Evans 11.2.

One female specimen at Katmandu 4,500 ft. 24-8-35 form *catilla*. Several at lower elevations including the Terai, December and January. Amlekganj 1,000 ft. 15-11-35.

54. **Catopsilia pyranthe pyranthe** L.

Talbot F.B.I. 168; Evans 11.4.

Two specimens at Katmandu 4,500 ft. 4-9-36 and 27-10-37. Plentiful at lower elevations especially at Devighat 1,500 ft. Larva on *Cassia laevigata* (Leguminosae). At the end of October and early November great numbers of larvae were pupating on the back of the leaves of the food plant, others were emerging and mating.

55. **Catopsilia florella gnoma** Fab.

Talbot F.B.I. 169; Evans 11.5.

Three specimens at Katmandu 4,500 ft. 7-4-38 and 7-7-38. Nagarkot 6,000 ft. 8-8-35. Very many at Devighat where the perfect insects were emerging at the end of October and early November. Pairs *in copula* on 27-10-35 and 30-10-35. The food plant is *Cassia laevigata* (Leguminosae). This insect flies with *C. pyranthe* in great numbers and the larvae feed on the same plant.

56. **Gonepterix rhamni nepalensis** Doubleday.

Talbot F.B.I. 172b; Evans 14.1.

Common in the Valley and on the surrounding hills. Katmandu 4,500 ft. May to November. On the surrounding hills up to 6,500 ft. late June to mid-August when there were a great many at Kakni. One brought in from Tsari on the Tibetan border, 14-6-36.

57. **Gonepterix mahaguru mahaguru** Gistel. (E)

Talbot F.B.I. 174a; Evans 14.3.

A few in the Valley; one at Kakni 7,000 ft. 15-4-37, and one brought in from Surjekunda 11-9-35.

58. **Eurema brigitta rubella** Wallace.

Talbot F.B.I. 176; Evans 15.1.

A few at Devighat, April and September, and a pair *in copula* 30-10-35. Baklore, Terai 4-4-36. A specimen brought from the Tibetan border, Laptang, 22-6-37.

59. **Eurema laeta laeta** Boisduval.

Talbot F.B.I. 177a; Evans 15.2.

Common everywhere in the Valley and on the surrounding hills up to 7,000 ft. at Devighat 1,500 ft. and in winter in the Terai. Wet season forms June to September. Dry season forms in May, October and in winter in the Terai. One wet season form was taken at Devighat on 25-11-35.

60. **Eurema blanda silhetana** Wallace.

Talbot F.B.I. 178a ; Evans 15.4.

Katmandu May, August and October. Devighat 1,500 ft. 15-1-35.

61. **Eurema hecabe fimbriata** Wallace.

Talbot F.B.I. 179c; Evans 15.5.

Very common in the Valley and on the surrounding hills during April and May and again from July to November. In the Terai December to February. Pairs were taken *in copula* 2-9-37 and 3-10-35.

62. **Colias erate erate** Esper. (E)

Talbot F.B.I. 194a; Evans 16.9.

Very common in the Valley from March to October, but never found on the hills above the Valley. A pair *in copula* at Katmandu 13-5-35. A female seen depositing eggs 16-3-35

63. **Colias electo fieldii** Ménétries.

Talbot F.B.I. 199; Evans 16.14.

Very common in the Valley and on the surrounding hills in March, April and May. A few in the Valley as late as October. Many brought in from the north and north-west of Nepal, May and June. A few in the Terai in February. A pair were taken *in copula* on 7-6-35.

64. **Ixias pyrene familiaris** Butler. (W)

Talbot F.B.I. 151d; Evans 17.2.

One in the Valley 6-4-34. and two brought in by the collectors from the north, Gumar Set 2-12-35. Silagarhi, West Nepal 28-10-36.

65. **Hebomia glaucippe glaucippe** L.

Talbot F.B.I. 161a; Evans 19.

Rare in the Nepal Valley; only seen March, April and September; Devighat 1,500 ft. 18-10-35.

66. **Valeria valeria hippia** Fabricius.

Talbot F.B.I. 164; Evans 20.3.

One at Katmandu 24-3-35. Chandragiri above the Valley 5,500 ft., 28-7-35, and a few at lower elevations.

Amlekganj 1,000 ft., 2-11-36. A few in the Terai in February.

DANAIDAE

67. **Danaus aglea melanoides** Moore.

Talbot F.B.I. 213b; Evans 2.1.

Common in the Valley March to October; at Chandragiri above the Valley, 7,000 ft., 14-6-36. Also taken in the Terai in February. One taken at Katmandu on 12-7-35, had orchid pollinia on the proboscis.

68. **Danaus sita** Kollar.

Talbot F.B.I. 217; Evans 2.5.

Only two specimens from the Valley. Form *tytia* Gray 14-5-37 and form *sita* Koll. 28-3-88.

One brought in from Siligarhi, West Nepal, 29-10-36 appears to be midway between the above two forms.

69. **Danaus limniace leopardus** Butler.

Talbot F.B.I. 210; Evans 2.9.

A single female specimen in the Valley 16-3-36. Several in the Terai in winter.

70. **Danaus hamata septentrionis** Butler.

Talbot F.B.I. 211c; Evans 2.10.

A few in the Valley in March, July, August and October. Common in the Terai in November.

71. **Danaus plexippus plexippus** L.

Talbot F.B.I, 207; Evans 2.12.

Common in the Valley March to October and up to 5,000 ft. on the surrounding hills; many in the Terai in winter.

72. **Danaus chrysippus chrysippus** L.

Talbot F.B.I. 206; Evans 2.15.

Very common in the Valley from March to October and in the Terai in winter. Larvae on *Calotropis procera* (Asclepiadacae). Pupations at Katmandu on 30.4 emerging on 11.5 and on 1.5 emerging on 7.9. Other emergences in May, June and September.

73. **Euploea mulciber mulciber** Cramer.

Talbot F.B.I. 231a; Evans 3.1.

Common in the Valley except November to February. On the surrounding hills at Nagarkot 7,000 ft. June, July and August.

74. **Euploea core core** Cramer.

Talbot F.B.I. 228a; Evans 3.7.

Common in the Valley June to August, and in the Terai in winter. Emergence dates 28-6-36, 19-7-37, 23-8-35 and 14-10-35.

SATYRIDAE

75. **Mycalesis francisca sanatana** M.

Talbot F.B.I. 243a; Evans 2.5.

Common in the Valley. D.S.F. in April and May. W.S.F. April, July and August. A single specimen from Nagarkot 7,000 ft. on 7-8-36. was W.S.F.

76. **Mycalesis perseus blasius** Fab.

Talbot F.B.I. 248b; Evans 2.9.

Not in the Valley but common at low altitudes in the Terai in the winter. All D.S.F.

77. **Mycalesis mineus mineus** L.

Talbot F.B.I. 249; Evans 2.10.

Both in the Valley and in the Terai. In the Valley W.S.F. were taken from May to September and D.S.F. in June and October. D.S.F. common in the Terai in winter.

78. **Mycalesis visala visala** M.

Talbot F.B.I. 252a; Evans 2.12.

A single specimen at 5,000 ft. in the Valley on 27-10-36. A few in the Terai in midwinter.

79. **Mycalesis suavolens suavolens** W-M. and DeN. (W)

Talbot F.B.I. 260a; Evans 2.23.

Nagarkot 7,000 ft. in June and July. Katmandu 5,500 ft. 23-5-37.

80. **Mycalesis heri** M.

Talbot F.B.I. 262; Evans 2.25.

Valley, May to August. Not common.

81. **Mycalesis nicotia** Westwood.

Talbot F.B.I. 264; Evans 2.27.

Common in the Valley, May to September. A few specimens at Nagarkot 7,000 ft. in June.

82. **Mycalesis malsara** M. (W)

Talbot F.B.I. 265; Evans 2.28.

A few at Bhimpedi below the Valley 1,000 ft. early October.

83. **Mycalesis lepcha lepcha** M. (E)

Talbot F.B.I. 267a; Evans 2.30.

D.S.F. common in the Valley, March to May. One W.S.F. 5-5-37 and others in July, August and September.

84. **Lethe sidonis sidonis** Hew.

Talbot F.B.I 273; Evans 3.3.

Common in the Valley in June and October and a few in the intervening months. Also on the surrounding hills up to 7,000 ft. Specimens from North-west Nepal approach form *vaivarta* Doh.

85. **Lethe nicetella** DeN. (W)

Talbot F.B.I. 275; Evans 3.4.

Three specimens only: Chandragiri 6,000 ft. above the Valley 24-6-36, 21-10-37; Godavari, 5,000 ft. 20-10-36. Always in thick forest.

86. **Lethe maitrya maitrya** DeN.

Talbot F.B.I. 276a; Evans 3.5.

Several specimens brought in by collectors from North Central Nepal in August 1937. Never taken in the Valley.

87. **Lethe jalaurida jalaurida** DeN. (W)

Talbot F.B.I. 282a; Evans 3.11.

A single specimen brought in from Jalbiri, North Central Nepal, 3-8-37.

88. **Lethe goalpara goalpara** M. (E)

Talbot F.B.I. 285a; Evans 3.14.

A single specimen brought in from Barabar, North Nepal, 20-8-35.

89. **Lethe baladeva** M. (W)

Talbot F.B.I. 288; Evans 3.17.

Four specimens only: Godavari, 5,000 ft., 10-5-37., Chitlang south of the Valley, 5,000 ft. 23-4-38. Two brought in from North Nepal by collectors, Dejen Gompa, 7-6-37, Patichaur, 14-5-37. I cannot distinguish the race *aisa* Fruh. from *baladeva* M. There is only one specimen of each sex of *aisa* in the British Museum.

90. **Lethe rohria rohria** Fd. (W)

Talbot F.B.I. 293a; Evans 3.22.

Three specimens from the Valley 1-11-36, 30-10-37 and 24-3-39, and one from Thankot above the Valley, 6,000 ft. 17-7-37.

91. **Lethe confusa confusa** Aur.

Talbot F.B.I. 296; Evans 3.25.

Very common in the Valley. The spring brood are on the average smaller than those appearing later.

92. **Lethe insana dinarbas** Hew.

Talbot F.B.I. 306b; Evans 3.34.

A few at Godavari in the Valley in May. Also on the surrounding hills up to 6,000 ft. April to November. A few brought in from the north by collectors in May. Always in thick forest.

93. **Lethe kansa** M.

Talbot F.B.I. 311; Evans 3.38.

A few in the Valley in April and May and again in October. A few at Nagarkot 7,000 ft. between July and November.

94. **Lethe verma sintica** Fruh. (W)

Talbot F.B.I. 317b; Evans 3.44.

Common in the Valley and on the surrounding hills between May and October.

95. **Lethe pulaha pulaha** M.

Talbot F.B.I. 318a; Evans 3.45.

A few brought from North Nepal in May and June. Barku 18-5-35; Sandi, 2-6-35; Kuti on the Tibetan border, 6-6-37; Dejen Gompa 7-6-37.

96. **Lethe yama yama** M.

Talbot F.B.I. 323a; Evans 3.50.

In the thick forest on the hills surrounding the Valley between 5,500 ft. and 7,000 ft. in May and June only.

97. **Pararge menava menava** M. (E)

Talbot F.B.I. 324a; Evans 4.1.

A single specimen from Nepko, West Nepal 11-6-36.

98. **Pararge schakra schakra** Koll. (E)

Talbot F.B.I. 325a; Evans 4.2.

Several brought in from West Nepal in June and July. Kalas, 17-6-36, Barai 19-6-36 and 3-7-36.

99. **Rhaphicera satricus satricus** Db. (W)

Talbot F.B.I. 330; Evans 4.7.

A single specimen taken at Kakni 7,500 ft. 15-9-37. Also two seen at the same place 14-8-35.

100. **Orinoma damaris** Gray.

Talbot F.B.I. 332; Evans 5.

Common in the Valley often at damp soil in May and June. A second brood in September and October.

101. **Aulocera brahminus brahminus** Blanch. (E)

Talbot F.B.I. 355a; Evans 11.1.

A single specimen brought in from Tangar, West Nepal, 7-8-36. Another specimen from Limotang, West Nepal, 16-7-36, appears to be race *brahminoides* M. This is an extension westwards.

102. **Aulocera padma padma** Koll.

Talbot F.B.I. 356a; Evans 11.2.

Many brought in by collectors from North Nepal, July, August and September.

Two specimens appeared to be *A. p. chumbica*: Jalbiri 3-8-37, Sanu Nyesum 20-7-37. If my identification is right this is an extension of habitat westwards.

Two specimens brought from Rasuagarhi 20-8-35, and Langdeng 30-8-35, are nearest to *A. p. loha* Doh.

103. **Aulocera swaha swaha** Koll.

Talbot F.B.I. 357a; Evans 11.3.

Many brought in from North Nepal and from the Tibetan border in July, August and September.

104. **Aulocera saraswati** Koll.

Talbot F.B.I. 358; Evans 11.4.

One from the Valley, 4,500 ft. 29-10-37; several from the surrounding hills in August, September and October. Others brought in from the north.

105. **Erebia nirmala nirmala** M. (E)

Talbot F.B.I. 363a; Evans 13.4.

A few brought in from West Nepal in June 1936.

106. **Erebia scanda opima** Watkins. (W)

Talbot F.B.I. 364b; Evans 13.5.

Swarms in August and into early September at Kakni and Nagarkot above the Valley between 6,000 ft. and 7,000 ft.

107. **Erebia hybrida** But. (E)

Talbot F.B.I. 365; Evans 13.6.

Very plentiful at water above Balaji in the Valley in April and again in August. A great many at Kakni, 7,000 ft, mid-August.

108. **Erebia annada caeca** Watkins.

Talbot F.B.I. 367b; Evans 13.7.

Very common in the woods surrounding the Valley in May and again in September.

E. annada annada M. also occurs at the same time and localities. If this identification is correct this is an extension of habitat westwards.

109. **Erebia hyagriva** M. (E)

Talbot F.B.I. 368; Evans 13.8.

A few in August and many in September and October, both in the Valley and on the surrounding hills.

110. **Ypthima nareda newara** M. (E)

Talbot F.B.I. 373b; Evans 14.4.

Common in the Valley and on the surrounding hills May to September. One emerged on 25th August at Nagarkot 6,500 ft.

111. **Ypthima ceylonica kasmira** M. (E)

Talbot F.B.I. 380c; Evans 14.11.

None in the Valley but some at lower elevations. Common in the Terai in winter.

112. **Ypthima baldus baldus** F.

Talbot F.B.I. 385a; Evans 14.15.

Very common in the Valley and also found in the surrounding hills up to 7,000 ft. Common in the Terai. A very dry form is found in the Valley in March. Pairs were taken *in copula* at Katmandu 20-9-35 and 16-8-37. Also at Devighat 1,500 ft. 25-10-35 and 31-10-35.

113. **Ypthima sakra nikaea** M. (E)

Talbot F.B.I. 390b; Evans 14.21.

Common in the Valley from April to October and also up to 7,000 ft. on the surrounding hills. A pair taken *in copula* at Katmandu 5-9-37 and another at Nagarkot, 7,000 ft. 22-7-37.

114. **Orsotrioena medus medus** Fab.

Talbot F.B.I. 393a; Evans 16.

Common below 5,000 ft. from August to April in all the parts of Nepal in which collections were made. W.S.F. were obtained in August and September, otherwise most specimens were D.S.F.

A single W.S.F. was taken at Tribeni in the Terai in December. A pair *in copula* at Devighat 30-10-35.

115. **Melanitis leda ismene** Cramer.

Talbot F.B.I. 405; Evans 22.1.

Common in the Valley and especially so in the Terai. W.S.F. were taken in August and September only. This crepuscular butterfly sometimes comes to light like a moth.

116. **Melanitis phedima bela** M. (W)

Talbot F.B.I. 406e; Evans 22.2.

Two specimens, one at Katmandu 4,500 ft. 9-10-36, and another at Godavari 5,000 ft. 20-10-36.

117. **Elymnias hypermnestra undularis** Drury.

Talbot F.B.I. 411c; Evans 25.1.

At various places below the Valley in October and November at altitudes between 1,000 ft. and 2,000 ft. Very common at Devighat.

118. **Elymnias malelas malelas** Hew. (W)

Talbot F.B.I. 418a; Evans 25.8.

A few in October both in the Valley and at lower elevations. One brought in from Central Nepal, Chauntara, 13-9-37. A pair *in copula* at Katmandu 2-10-37.

119. **Elymnias vasudeva vasudeva** M. (W)

Talbot F.B.I. 422a; Evans 25.12.

A single specimen brought in by collectors from Trisuli, 25-7-35.

AMATHUSIIDAE

120. **Discophora sondaica zal** Wstw. (W)

Talbot F.B.I. 443b; Evans 10.1.

A single male specimen was taken below Nayakot at 3,000 ft. 2-4-35. It was sucking moisture on the road. This is an extension of the Amathusiidae westwards in the Himalayas. The family occurs in South India.

NYMPHALIDAE

121. **Charaxes polyxena hierax** Fd. (W)

Evans 1.2.

A single ♂ specimen at Amlekganj 1,000 ft. 2-11.36.

122. **Eriboea athamas athamas** Dr.

Evans 2.2.

A few in the Valley in September and October.

123. **Eriboea dolon centralis** Roth. (W)

Evans 2.7.

Valley, April and May.

124. **Eriboea eudamippus eudamippus** Db.

Evans 2.10.

Three specimens in the Valley 4,500 ft. 10-6-34; 5,000 ft. 23-5-36; 5,000 ft. 3-10-37.

125. **Dilipa morgiana** Wd.

Evans 5.

A few in the Valley, mostly at water, May, June and July. One from Laptang near the Tibetan frontier 22-6-37.

126. **Sephisa chandra** M. (W)

Evans 9.2.

Males are common on the hills surrounding the Valley where they fly round treetops. A few in May and July and many in September and October. One female of the *albina* form on 20-10-36.

127. **Euripus consimilis** Wd.

Evans 10.1.

A single male specimen feeding on a peach in the Legation garden at Katmandu on 27-6-37.

128. **Diagora persimilis persimilis** Wd. (W)

Evans 11.1.

Four males in the Valley, April, May, July and September; some at water.

129. **Diagora nicévillei** M. (E)

Evans 11.2.

Several males in May at Godavari. See *Journal of the Bombay Natural History Society*, Vol. 42, p. 819 and Vol. 43, p. 537. This butterfly is named from a single specimen obtained by De Niceville in 1879. No further specimens were obtained until I found it not uncommon in the woods at the fringe of the Valley.

130. **Hestina nama** Db.

Evans 12.

Common in the Valley between May and November. Males fly in the morning round isolated hilltops on the ranges surrounding the Valley.

131. **Dichorragia nesimachus** Bdv.

Evans 16.

Only two specimens taken in the Valley, 23-6-37.

132. **Stibochioma nicea nicea** Gray.

Evans 17.

Common in the woods in and around the Valley, April to October.

133. **Euthalia lepidea lepidea** But.

Evans 18.3.

Plentiful at Devighat (1,500 ft.) in November and December and at lower levels outside the Valley. A single specimen was taken at Godavari in the Valley on 17-4-38. It was also found in the Terai in winter.

134. **Euthalia julii appiades** Men.

Evans 18.6.

Devighat 2,000 ft., 31-10-35. A few brought in by collectors from lower levels outside the Valley.

135. **Euthalia kesava arhat** Fruh. (W)

Evans 18.8.

A single female specimen at Bhimpedi, 1,000 ft. early October 1936.

136. **Euthalia telchinia** Men. (W)

Evans 18.10.

Three specimens in the Valley 5-6-35, and 6-6-36, and a female on 3-10-36.

137. **Euthalia garuda suddhodana** Fruh.

Evans 18.14.

One female in the Valley, 30-10-36. Several of both sexes at Devighat, 2,000 ft. 31-10-35.

138. **Euthalia nara nara** M. (W)

Evans 18.21.

Plentiful on the hills surrounding the Valley up to 7,000′, May to August, and a few in the Valley itself.

139. **Euthalia sahadeva sahadeva** M. (W)

Evans 18.23.

As the last. In the Valley and on the surrounding hills up to 7,000 ft.

140. **Euthalia patala patala** Koll.

Evans 18.26.

Common in thick forests in the Valley only in May and June.

141. **Abrota ganga** M.

Evans 23.

A few in the Valley, June and July.

142. **Limenitis danava** M.

Evans 24.2.

Males common in the Valley, April and May. A few in October which are rather larger and darker than the spring brood. A few females were seen in August and October.

143. **Limenitis dudu** Wd. (W)

Evans 24.5.

A few in the Valley, April and May. A single specimen in August and another in October.

144. **Limenitis procris procris** Cr.

Evans 24.7.

A few in the Terai in winter and one at Devighat 2,000 ft. 25-10-35. Not seen in the Valley.

145. **Limenitis trivena pallida** Tyt.

Evans 24.8.

A few brought by collectors from West Nepal in June 1936.

146. **Pantoporia nefte inara** Db. (W)

Evans 25.2.

One in the Valley and several in the Terai and at Devighat in winter.

147. **Pantoporia cama** M.

Evans 25.3.

In the Valley, April to October. At Nagarkot 7,000 ft. July to September. One at Devighat 1,500 ft. 25-12-34.

148. **Pantoporia selenophora selenophora** Koll.

Evans 25.4.

A few in the Valley, March to August and again in October. One at Devighat 1,500 ft. 3-11-36.

149. **Pantoporia opalina opalina** Koll.

Evans 25.8.

Very common in the Valley and on the surrounding hills between April and October. A larva found on *Berberis asiatica* Roxb. (Berberidaceae). Pupated on the 10th of August and emerged on the 27th of the same month.

150. **Pantoporia perius** L.

Evans 25.14.

Plentiful in the Valley and on the surrounding hills where it flies round isolated hilltops along with males of *Hestina nama*, *Sephisa chandra* and *Teinopalpus*. Also common at lower elevations at Devighat and in the Terai in winter.

151. **Pantoporia jina jina** M.

Evans 25.15.

Three specimens in the hills above the Valley: Nagarkot 6,000 ft. 4-7-35; Godavari 6,000 ft. 28-7-37; 5,000 ft. 19-5-38.

152. **Neptis columella ophiana** M.

Evans 26.1.

Only at low elevations outside the Valley. Bhimpedi 2,000 ft. October '36. East Terai 2-3-36.

153. **Neptis mahendra** M. (E)

Evans 26.5.

Two specimens from West Nepal in June.

154. **Neptis hylas varmona** M.

Evans 26.6.

The low elevation form *varmona* is common in the Terai and at Devighat below the Valley. A few of this form were taken along with the *astola* form, which is more plentiful in the Valley and which is also found on the surrounding hills from March to November. Specimens taken in June and July are very dark on the underside.

155. **Neptis nandina susruta** M.

Evans 26.8.

A few in the Valley in spring. Nagarkot 5,000 ft. 10-4-35. Katmandu 11-5-35. Godavari 5,000 ft. 19-5-36.

156. **Neptis yerburyi** But.

Evans 26.9.

Common in the Valley and a few on the surrounding hills, March to October; a few in the Terai in winter.

Pairs were caught *in copula* on 24-8-35 and 16-4-36. Both *yerburyi yerburyi* But. and *yerburyi sikkima* Ev. were obtained. Specimens of *y. yerburyi* were taken in the spring and *y. sikkima* in the autumn.

157. **Neptis sankara** Koll.

Evans 26.10.

Three specimens at Godavari in the Valley. That taken on 9-5-37 is *sankara sankara* ; the other two on 20-5-34 and 14-8-37 are *sankara quilta* Swin.

158. **Neptis cartica cartica** M. (W)

Evans 26.13.

Not uncommon in the Valley. A brood appeared in May and another in August.

159. **Neptis ananta ochracea** Evans.

Evans 26.15.

Common in the Valley in May. Two specimens at Nagarkot 7,000 ft. 8-9-35 and 5,000 ft. 10-9-35.

160. **Neptis miah miah** M. (W)

Evans 26.16.

One specimen at Bhimpedi below the Valley 2,000 ft. early October 1936, and one specimen at Katmandu, 4,500 ft. 13-5-35.

161. **Neptis antilope melba** Ev. (W)

Evans 26.18.

Four specimens at Godavari in May 1937.

162. **Neptis manasa** M. (W)

Evans 26.21.

A few were taken at Godavari 5,000 ft. in May 1937, but at no other time or place.

163. **Neptis nycteus nycteus** DeN. (W)

Evans 26.22.

Two specimens at Godavari 5,000 ft. 15-5-37. 19-5-38.

164. **Neptis narayana nana** DeN. (W)

Evans 26.23.

Not uncommon in the Valley but only taken in May.

165. **Neptis hordonia hordonia** Stol.

Evans 26.32.

Common at Devighat and other places below the Valley.

166. **Cyrestis thyodamas thyodamas** Boisduval.

Evans 27.4.

Common in the Valley ; often at water and damp soil. One specimen at Devighat, 1,500 ft. 31-3-35 ; several at Nagarkot 6,500 ft. in September. The specimens vary between the forms *ganescha* Koll. and *thyodamas* Bdv.

167. **Chersonesia risa** Db. & Hew.

Evans 28.1.

A single specimen at Nowakot north of the Valley, 3,000 ft. 17-10-35.

168. **Pseudergolis wedah** Koll.

Evans 29.

Not uncommon at Godavari in the Valley in October.

169. **Hypolimnas misippus** L.

Evans 30.1.

Several males in the Valley in September and October.

170. **Hypolimnas bolina** L.

Evans 30.2.

None in the Valley but a few at Nagarkot between 6,000 ft., and 7,000 ft. in September; also several in the Terai in winter. A pair were taken *in copula* at Nagarkot 6,000 ft. 31-7-37.

171. **Kallima inachus inachus** Bdv.

Evans 34.2.

Many in the Valley, March to October. More plentiful in the spring. At lower elevations in October.

172. **Precis hierta hierta** F.

Evans 35.1.

Not uncommon in the Valley from March to May; a second brood appears from August to October. Common at Nagarkot up to 7,000 ft. Pairs were taken *in copula* in July.

173. **Precis orithya swinhoei** But.

Evans 35.2.

Very common in the Valley, March to August. Also common on the surrounding hills up to 7,000 ft. between July and the 8th of November. Also common in the Terai. The Terai winter form is paler than the specimens taken in the Valley in summer. Several were taken *in copula* at Nagarkot in July.

174. **Precis lemonias persicaria** Fruh.

Evans 35.3.

Common in the Valley. D. S. F. from January to April; W.S.F. in August. D. S. F. in the Terai in December and January.

175. **Precis almana almana** L.

Evans 35.4.

In the Valley D. S. F. were found from September to November and W.S.F. June to August. In the Terai and at lower elevations the D.S.F. was common October to February.

176. **Precis atlites** L.

Evans 355.

A single specimen at Balaji in the Valley 4,500 ft. 2-9-37. Many in damp scrub at Devighat 1,500 ft. at the end of October.

177. **Precis iphita siccata** Stich.

Evans 35.6.

Common in the Valley all the year except November to February. Females were seen ovipositing at Balaji in the Valley 29-7-35, and at Nagarkot 6,000 ft. 2-9-35.

178. **Vanessa cardui** L.

Evans 36.1.

Common in the Valley and up to 7,000 ft. at Nagarkot in the surrounding hills. It is found all the year round except from November to February. In the Terai in winter.

179. **Vanessa indica indica** Herbst.

Evans 36.3.

Very common in the Valley. A spring brood appeared in March and April and an autumn in July and August. Again very many appear in October and November after which they are not seen till March. Many larvae and pupae were found in colonies on nettles. One emergence in July and many in October and November.

180. **Vanessa canace canace** L.

Evans 36.4.

Common in all localities, in the Valley, on the surrounding hills, and at lower elevations outside. Not seen during December, January and February. A larva was found on *Smilax macrophylla* (Liliaceae) pupated on 22-8-35, and emerged on 2-9-35. Most are sub-species *canace* L. but some approach *himalaya* Evans.

181. **Vanessa cashmirensis aesis** Fruh.

Evans 36.10.

Very common everywhere except during December, January and February. Many emerged at the end of October.

182. **Vanessa xanthomelas fervescens** Stich. (E)

Evans 36. 11.

One in the Valley 5,000 ft. 9-3-36. One at Nagarkot 7,000 ft. 8-5-37, and one brought in from Patichaur in north Nepal 11-11-37.

183. **Symbrenthia hippoclus khasiana** M.

Evans 38.1.

Appears in considerable numbers in the Valley in March.

184. **Symbrenthia hypselis cotanda** M.

Evans 38.3.

A few in the Valley in March and April. A fresh brood appears in September and October. It is found both in the Valley and in the hills up to 7,000 ft.

185. **Argynnis hyperbius hyperbius** L.

Evans 39.1.

Common in the Valley and the surrounding hills; more plentiful from June to September. Pair *in copula* 12-9-37.

Emergences on 3-10-35, 1-11-35 and 9-10-36.

186. **Argynnis childreni childreni** Gray.

Evans 39.2.

Not uncommon in the Valley and on the surrounding hills up to 7,000 ft., from May to July; a few in October. It was not seen in the Terai or at lower elevations. Several were brought in from North Nepal by collectors.

187. **Argynnis kamala** M. (E)

Evans 39.3.

A few brought from western Nepal June, July and August.

188. **Argynnis lathonia issoea** Db.

Evans 39.8.

In the Valley and the surrounding hills from March to June. A great many brought in from western and northern Nepal in May and June. A pair *in copula* 15-5-37.

189. **Melitaea arcesia irma** Higgins. (*Transactions R. Ent. Soc.* Vol. 9. Part 7. 1941.)

Evans 40.7.

Many brought in from West Nepal in July and August 1936.

190. **Cupha erymanthus lotis** Sulz.

Evans 41.

A few in the Valley and surrounding hills from May to August; a single specimen in October.

191. **Atella phalanta** Drury.

Evans 42.1.

A few in the Valley, and the surrounding hills from May to October. An egg deposited on 15-8-35, hatched on 21-8-35 and the imago emerged on 11-9-35.

192. **Issoria sinha sinha** Koll.

Evans 43.

A few in the Valley, June to October. One taken in the Terai on 16-1-36 is form *pallida* Evans.

193. **Cynthia erota erota** F. (W)

Evans 44.

A single worn specimen at Nagarkot 6,000 ft. 3-7-37.

194. **Cethosia biblis tisamena** Fruh. (W)

Evans 47.1.

Common in the Valley, March to April. A second brood appearing from August to October. Many larvae on Passion Flower (Passifloraceae) in the Legation garden pupated in December 1936; of these two emerged on 7-3-37 and five on 11-3-37. Eggs on Passion Flower hatched on 17-8-37. Seven of these pupated on 6-9-37, and others a few days later. These emerged as perfect insects on 16th, 17th and 18th of September the same year.

195. **Ergolis ariadne pallidior** Fruh.

Evans 49.1.

A single specimen from the western Terai on 2-1-37.

196. **Ergolis merione assama** Ev. (E)

Evans 49.2.

Not uncommon in the Valley but only found in September and October. A single specimen at Devighat 1,500 ft. 25-11-34.

ACRAEIDAE

197. **Acraea issoria issoria** Hub.

Talbot F.B.I. 450a; Evans 51.

Kakni, above the Valley, 7,000 ft., June to September. In September the butterflies were seen emerging in great numbers.

The separation into sub-species by size does not seem to be justified. According to Talbot in F.B.I. *A.i. issoria* Hub. (50 to 70 mm.) is from the eastern Himalayas while *A.i. anomala* Koll. (45 to 65 mm.) is from the western Himalayas. The largest specimens I have are from the Simla Hills; a male is 70 mm. and a female 80 mm.

(*To be continued*)

TWO NEW SPECIES OF PIMPINELLA

BY

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The author, while identifying the Umbelifers of his collection of Nepal plants, came across two hitherto undescribed species of *Pimpinella* in the Herbarium, Indian Botanic Garden, Calcutta.

These species have not been listed by Wolff in his monograph of the genus in Engler, Pflanzenr. IV, 288 (1927). They are not given in the subsequent supplements of the *Index Kewensis* either.

Pimpinella clarkeana Watt ex Banerji, spec. nov.

Herba erecta, parva, tenuis, 15-30 cm. alta, caulibus teretibus, striatis, non ramosis, cavis. *Folia* radicalia atque caulina, membranacea, glabra. Folia radicalia longe petiolata, patentia, 3-foliolata; petiolus tenuis, complanatus, 5-15 cm. longus, ad basim alatus alis squamae similibus; foliola 1.5-4.5 × 1-3.5 cm., ovata, simplicia vel praesertim foliolum terminale 2-3-lobata vel 2-3-fida (folioli bilobati segmenta varia, inaequalia), cuneata vel rotundata ad basim, foliolum terminale regulare, caetera inaequalia, ad margines alte serrata, acuta ad apices; petioluli 2.5-7.5 mm. longi. Folia caulina multo minora, 3-fida vel 3-lobata, petiolis 1-2 cm. longis.

Inflorescentia terminalis, ad 4 cm. diam.; radii primarii inaequales longitudine, 12-17 numero, ut plurimum erecti; bracteae nullae. Radii secundarii tenues, inaequales longitudine, 0.5-2 cm. longi, 3-5-flori; bracteolae 1-3, lanceolatae; pediculis circa 4 mm. longis. Flores albi, hermaphroditi. Calycis segmenta lanceolata; petala glabra, obovata, emarginata. Fructus oblongus, circa 4 mm. longus, tenuiter assymmetricus; sulci 2-3-vittati; carpophorio bifido.

Typus, G. Watt 6556, lectus in loco Chingsow, Manipur (Assam), altit. 8000 ped., die 18 mensis aprilis, 1882, invenitur in Herb. Calcut.; *paratypus*, Banerji 446, lectus in loco 'Arun Watershed' (Nepalia), altit. circa 10,000 ped., die 21 mensis maii 1948, invenitur in Herb. Calcut., et Blatter Herb., St. Xavier's College, Bombay, et Herb. Meerut College, Meerut.

Pimpinella clarkeana Watt ex Banerji, spec. nov.

A slender, small, erect herb, 15-30 cm. high, with rounded and striate, unbranched, hollow stems. *Leaves* radical and cauline, membranous, glabrous. Radical leaves long-petioled, spreading, 3-foliate; petioles slender, flattened, 5-15 cm. long, base often with scale-like wings; leaflets 1.5-4.5 × 1-3.5 cm., ovate, simple or, especially the terminal one, 2-3-lobed or-fid (in 2-lobed leaflets the lobes various, unequal); base of leaflets cuneate or rounded, in the terminal one regular, in the lateral leaflets often unequal-sided; margins deeply serrate, tips acute; petiolules 2.5-7.5 mm. long. Cauline leaves much smaller, 3-fid or -lobed, petioles 1-2 cm. long.

Inflorescence terminal, up to 4 cm. diam., primary rays unequal in length, 12-17 in number, mostly erect; bracts none. Secondary rays slender, unequal in length, 0.5-2 cm. long, 3-5-flowered; bracteoles 1-3, lanceolate; pedicels about 4 mm. long; flowers white; hermaphrodite. Segments of the clayx limb lanceolate; petals glabrous, obovate, emarginate. Fruit oblong, about 4 mm. long, slightly asymmetrical; furrows 2-3-vittate; carpophore bifid.

The *type*, G. Watt 6556, was collected at Chingsow, Manipur (Assam), at an altitude of 8,000 ft., on 18 April 1882; the *paratype*, Banerji 446, was collected at the Arun Watershed (Nepal), at about 10,000 ft. altitude on May 21st, 1948.

Pimpinella urceolata Watt ex Banerji, spec. nov.

Herba robusta, alta, erecta, 30-50 cm. alta, caulibus teretibus, striatis, ramosis, cavis. *Folia* membranacea, glabra, ut plurimum caulina; radicalia folia raro adsunt; cum vero adsunt, sunt indivisa. Folia caulina 3-foliolata, petiolis complanatis atque tenuiter striatis, 4-8 (generatim 8) cm. longis, pilosis. Foliola tenuiter pilosa, ovata, 1.5-4 × 2-4.5 cm.; foliolum terminale in inferioribus foliis tripartitum, in superioribus vero indivisum, omnia glabra vel glabrescentia supra, pilosa infra praesertim ad nervos; ad margines serrata, ad basim ut plurimum cordata, aliquando tamen rotundata vel cuneata, ad apices acuta vel acuminata; petioluli 5-15 mm. longi, raro longiores, tenuiter pilosi.

Inflorescentia terminalis vel axillaris vel folio opposita; radii primarii 9-12, longitudine inaequales, circa 15 mm. longi, patentes; bracteae nullae. Radii secundarii 6-9 (ut plurimum 8); bracteolae 3-5, filiformes, 2-4 mm. longae, tomentosae. Flores albi, minuti, hermaphroditi; pediculis 5 mm. longis, nonnumquam tamen brevioribus. Calycis limbus squamae similis; petala glabra medio nervo prominenti ornata, tenuiter mucronata; stamina petalis aequalia. Fructus 2, raro 2.5 mm. longus, lateraliter compressus, initio pilosus, tandem pubescens, oblongus; sulci tenues; stylopodium capitatum.

Typus, Anderson 623, lectus in Sikkim, in loco Tonglo, altit. 3,500 ped: die 2 octobris 1862, invenitur in Herb. Calcut.; *paratypi* (*a*) duo specimina in Herb. Calcut. ex loco Tonglo absque nomine auctoris, lecta die 1 octobris 1857; (*b*) Kurz, tria specimina in Herb. Calcut. absque numero, lecta die 14 octobris 1868 and die 21 octobris 1868, ex loco Tonglo?; (*c*) Gamble, ex loco Tonglo, 9,000 ped. altit., lectus mense julio 1882.

Pimpinella urceolata Watt ex Banerji, spec. nov.

Tall, robust, erect herb, 30-50 cm. high, with rounded striate, branched, hollow stems. *Leaves* membranous, glabrous, mostly cauline, the radical ones seldom present and then undivided. Cauline leaves 3-foliate, petioles flattened and slightly striate, 4-8 (generally 8) cm. long, hairy. Leaflets slightly hairy, ovate, 1.5-4 × 2-4.5 cm., the terminal leaflets in the lower leaves 3-partite, in the upper ones undivided, glabrous or nearly so above, hairy beneath especially along the nerves; margins serrate, base mostly cordate, occasionally rounded to cuneate, tip acute or acuminate; petiolules 5-15 mm long, rarely longer, slightly hairy.

Inflorescence terminal, axillary or leaf-opposed; primary rays 9-12, unequal in length, about 15 mm. long, spreading; bracts none. Secondary rays 6-9 (mostly 8); bracteoles 3-5, filiform, 2-4 mm. long, tomentose. Flowers white, minute, hermaphrodite; pedicels 5 mm. long, occasionally shorter. Calyx limb scale-like; petals glabrous with a somewhat prominent midrib, slightly mucronate; stamens equalling the petals. Fruit 2, rarely 2.5 mm. long, laterally compressed, at the beginning pilose, at length pubescent, oblong; ridges faint; stylopod capitate.

Type, Anderson 623, from Tonglo in Sikkim, collected at 3,500 ft. altit., on Oct. 2, 1862; *paratypes* (*a*) two sheets in Herb. Calcut. from Tonglo, without collector's name, gathered on Oct. 1, 1857; (*b*) Kurz, three sheets in Herb. Calcut. without number, collected on Oct. 14, 1868 and Oct. 21, 1868, at Tonglo? (*c*) Gamble, Tonglo, 9,000 ft. altit. July 1882.

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FORTY YEARS OF SPORT ON LITTLE KNOWN ASSAM RIVERS

BY

W. E. D. COOPER

PART I

(*With two plates*)

My first Christmas day in India in 1900 was spent in a houseboat on the lower reaches of the Barak River which fired me with a desire to see what lay above, an urge I never lost and was nearly able to complete as far as these rivers were navigable, 30 odd years later. The Barak flows from the state of Manipur into the plains of Cachar and eventually into the delta of the Brahmaputra. It is fed by four main hill rivers above where it enters the plains of Cachar which were all the home of the noble Mahseer. Of these the Tepi', coming from the Lushai hills, was my first and last love, but I had also excellent sport on the Jheeri and later on, when I was able to get there, on the Macrup and Irung by hauling boats through the Big Gorge and over the Elephant Rocks, which, in my earlier days, were considered impassable. Three years later a friend and I, on a fortnight's leave, managed with a crew of six, a cook and a bearer to drag a houseboat up the rapids to within half a day of the mouth of the Tepi', which we reached in a dugout in seven or eight days, a trip we did in three days with the aid of a motor boat up to the first rapid, in later years. The country then was quite unspoilt, and with the exception of a wandering Lushai or Kooki, one saw no human beings.

We had no fishing tackle with us and I well remember seeing shoals of fish leaving the shallows. Shooting, however, was good and we had no difficulty in keeping the camp supplied with meat. This consisted chiefly of sambar and barking deer, with plenty of junglefowl, pheasants and pigeons of various sorts, with occasional duck and teal. What we could not eat was dried over camp fires on a bamboo frame and taken home for consumption by the crew. Turtle eggs were plentiful and excellent eating.

Camping on a sandbank was fairly primitive and I remember a tiger walking down to drink one night between a Boy Scout tent which we were sleeping in, and the cook under a tarpaulin a few yards away. As after this I always kept a big log fire going all night it never happened again.

Two years later I managed to acquire some fishing tackle, and with another friend, set off in two small and two large dugouts with a crew of twelve and reached the first rapid at Minadhur in two days, here the fishing water began. Our tackle consisted of bamboo trolling rods and a fly rod each, some No. 7 and 8 spoons and fly spoons. The first mahseer I caught was 27 lb. It took my 150 yards of line out to the wood of my reel, but having 'Griffin's luck', stopped at that moment and with the aid of my boatmen, I managed to land him by beaching on a spit of sand. I know nothing that gave me such a thrill as the first rush of that mahseer!

We explored the 'Tepi' and caught fish, also got as far as the Big Gorge on the Barak, a rather awe-inspiring length of the river, which here narrows down from one to two hundred yards width to twenty or thirty, rushing down between huge blocks of rock which have come down from the overhanging cliffs, through which I did not take the boats till 25 years later. I see from an old record that I landed 90 lb. of mahseer and we shot 14 pheasants, 39 junglefowl and 2 deer, which does not in anyway represent the fish hooked or ammunition expended. I was also up the Barak in 1906 when I landed 108 lb. of fish and shot an 18 ft. Gharial (Long-nosed Crocodile) up the Tepi'. In these early days one saw a dozen or more basking on sandbanks, but this was the first time I had an H. V. rifle capable of severing the spinal chord at the neck, the one shot that will prevent them slipping back into the water. I remember trying to gaff one whose back had been broken from a dugout which would have caused a disaster if I had not let it take my gaff.

In 1908 I went up with my brother for three weeks at Christmas and discovered that mahseer go clean off in very cold weather, the fishing was poor, so all subsequent trips were made in November as soon as these rivers had cleared sufficiently to fish.

I left this district in 1908 and it was not till 1916 that I was able to fish again, this time with an experienced fisherman who taught me how to use a fly on the smaller rivers. I also started to write up a log over the camp fire every night from which I shall quote in the rest of this story.

The Jheeri, a pleasant little hill river without the magnificent scenery of the Barak, we could reach by a track, on horseback, riding out some 25 miles to a spot where we had sent our boats three days before. These were newly built boats with flat bottoms. much more comfortable than dugouts to fish from. In later years I built my own at a cost of Rs. 1/6 per ft., supplying planks and fittings myself.

The flies we used were large salmon flies which we called Yellow Spider and Claret & Mallard, a 10 ft. split cane and a short American spinning rod were my first tools. I also used a fly spoon a lot which, was especially effective when water was at all discoloured. In a week's fishing my mentor landed 77 fish and I 55, the best fish weighing 7 lb. I lost a good few, especially on the short spinning rod.

In 1917 the Jheeri again with the same companion. We had by this time formed an Angling Association which hired the fishing rights on this river from Government, and kept two watchers to prevent netting when the rivers were low. On this trip, using similar methods we landed 140 fish between us, the best 10 lb. I have never known a mahseer over 10 lb. to take a fly; anything bigger was caught spinning or trolling.

When at the top of the river we heard drums beating all over the hills, and on our arrival back in civilization three days later were told that the hill people were in revolt, had burnt all the rest houses on the track into Manipur and killed the caretakers. They did not interfere with us. This revolt was not squashed for two years, the ringleaders being rounded up on a hill above where we were camped when we heard the drums.

In 1923 and 1924 I fished the Jheeri again with less experienced companions. We caught rather fewer fish than on previous trips, and there was not a great deal to shoot on this river, but we had enough for the pot. Otters were common in packs, and as they spoilt the fishing, were shot. I also remember seeing a pack of red dog in full cry after a sambar, making a noise rather more like a monkey than a hound. When the sambar eventually stands, they jump up and blind it with their teeth, without leaving a mark on its face, and then tear it to pieces. A friend of mine actually watched this taking place.

I see we had some difficulty in getting to our boats, as, after swimming our horse across the Jheeri, found all bridges had been washed away and we had to walk the last five miles. Also that on the last trip I landed a 10 lb. mahseer after falling on my back in the boat and dislodging my reel. The catch was 78 fish, the majority caught on a Claret and Mallard.

Up the Barak again after seventeen years, with two ladies. Our companions on this trip were experienced campers and really knew how to do things in comfort. My boats were sent off two days ahead, and, leaving in a motorboat we were at the first rapid in a morning to find camp all ready for us

Three days slogging up rapids brought us to the mouth of the Tepi' with little fishing on the way as the river was full up with timber rafts and bamboo cutters; very different from what I remember it.

There was, however, a lovely new sandbank at the mouth of the Tepi' which looked promising and on which we made our permanent camp. Gharial were still fairly plentiful and my companion, who had not fished before, spent most of his time after them whilst I fished the Tepi' where it was thrilling to recognise scenes of early adventure.

The top gorge produced a 24 lb. mahseer which, with my wife and three men in the boat, took some landing as both banks were sheer rock and we had to use the net. Our friends had brought up a bottle of champagne to be opened for the first fish over 20 lb. so we were soon celebrating. What I had learnt on the Jheeri served me in good stead on the Tepi' which I soon discovered was the perfect fly river, and landed 10 good fish on the evening rise. In this type of fishing the boatmen, without taking their paddles out of the water keep one at casting distance from the rocky banks, and by casting from a sitting position low down in the boat many more fish were hooked than when standing up, especially when water was very clear. It did not seem to matter much whether one fished up or down except in fast water, when by fishing up one did not overrun the water.

Paddling down slowly I watched two fishing cats scooping up small fish from an overhanging branch. I shot one with a pretty and rather rare skin. Having warned our companions not to get benighted as there were several bad rapids to be negotiated, I sent them up to troll the top gorges and had some good sport with a fly spoon lower down. My diary for that evening was as follows:

'W, though an experienced camper had not done any fishing, went up the Tepi' with his wife to troll the two top gorges and we followed later. Owing to a landslide water dirty and fish not taking a fly at all. Only one little mahseer in the morning, but had a good evening rise, all good fish which I landed safely, chiefly on a fly spoon after some excitements and got back to camp at dark to find the servants had killed a good barking deer, chased into the rapids by wild dogs. No sign of the W's so sent off a boat with lamp and torch. Began to get alarmed as they did not arrive till 7-30 p.m. having been benighted and upset in a rapid. They had got on to a rock on one side of the river, while their crew, who had gone overboard were washed to the other with the boat, all in the pitch dark. Glad to have everyone back in camp safely. An exciting day all round and an unpleasant experience for the W's who will get back in daylight in future when bad rapids have to be negotiated. W had caught his first fish and stayed too long in the gorge. I had 6 good fish and a pigeon.'

On the way down the Barak, still full of elephants and timber watched a young elephant having a great game with the rafts which it was trying to break up till its mother's mahout intervened.

At the top of one quiet rapid I hooked the biggest mahseer I have landed in these rivers, 37 lb., after a good long fight. A little further down found W with a 17 ft. Gharial he had killed at well over 100 yards and helped him get it down to our camp on the Kommandhur pool where I remember in an earlier trip a friend landed 6 mahseer between 20 and 30 lb. each one afternoon. Dropping down to join our motorboat, stalked and shot a 13 ft. Gharial, just the size my wife requires for a suitcase.

The next two years, seeking new pastures, I sent my boats into the Sonai, a river flowing from Lushai into the Barak lower down. Two young friends had borrowed my boats in January a year before, and had done quite well spinning until chased out by a rogue elephant. On neither trip were we lucky with the water which was too cloudy. Owing to the sandy bottom being full of snags in the shape of trees that had been washed down in the monsoon, we lost two out of three fish hooked on light fly tackle. The following extracts from my diary are typical of our sport in the upper reaches :—

'Left camp 7-30, water high but clearing, got into a fine gorge at 12 and had lunch with B who went down and I up. Nothing but thrills from the time he left. A big one took on my short rod, but hooks came away after he had taken out 30 yards of line, lost another and landed one on the fly rod, then got into another big fish on fly which ran down a rapid taking all my line before I could get the boat round, and broke me. A cheerful afternoon of combined bad luck and bad management in a fine wild country. B had 2 fish and had risen several; also had seen 4 red dogs and shot several pigeons.

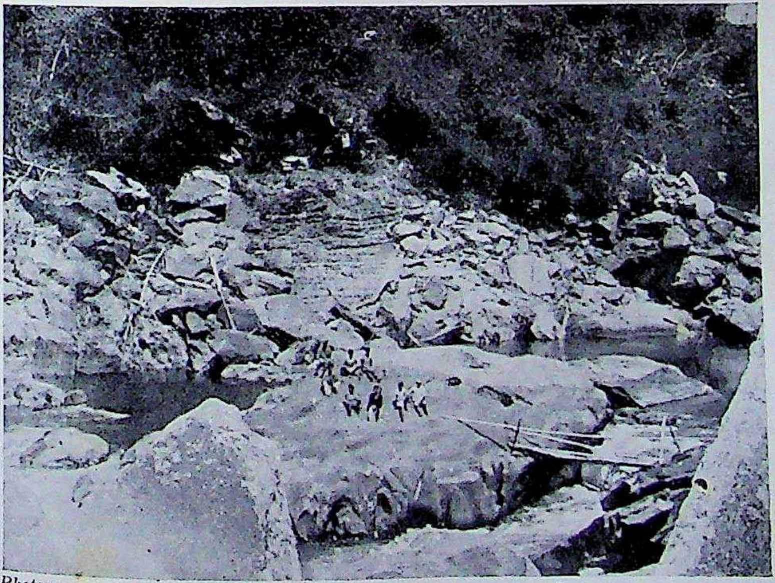
Left at 8 a.m. for the gorge country again in shikar boats, not a fish moving in the morning, but shot a sambar where a big fish broke me yesterday. Had lunch with B who started down whilst I picked up the sambar I had cached. Ran a few fish and landed a nice little 5 lb. mahseer on a fly, reached camp at dark and found B with one decent fish and a broken fly rod. Also shot a garganey and pigeons.

Made a late start, *mahl* (baggage) boats left ahead for our second camp. Tried everything in the morning but nothing taking. Put on a Claret and Mallard 3 p.m. and fish came on well. Reached our second camp late with 7 fish, the best 5 lb; B had only one.'

I also shot a Monitor lizard 8 ft. long with an H. V. rifle, far the biggest I have ever seen in these parts.

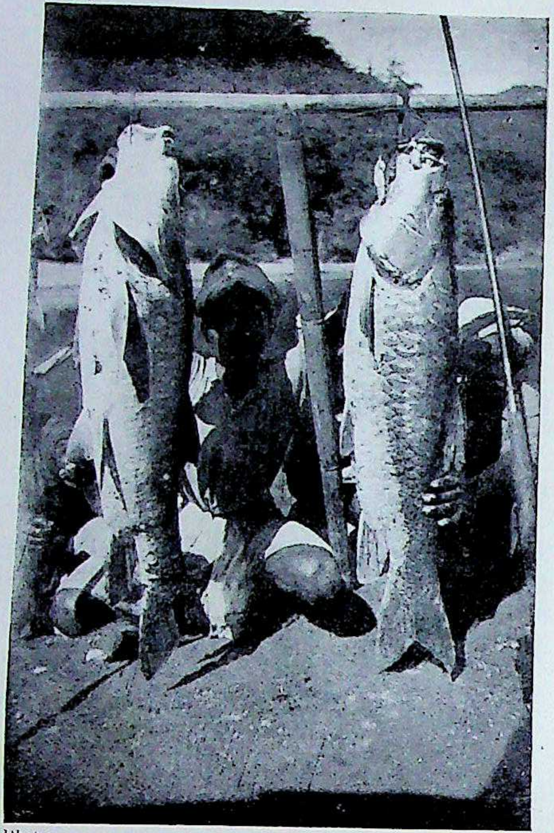
The Barak again in 1928 with the same party as in '25 and did not reach the mouth of Tepi' till the fourth day owing to heavy water. Camps were all on island sandbanks with a rapid on each side which

Camping in comfort.



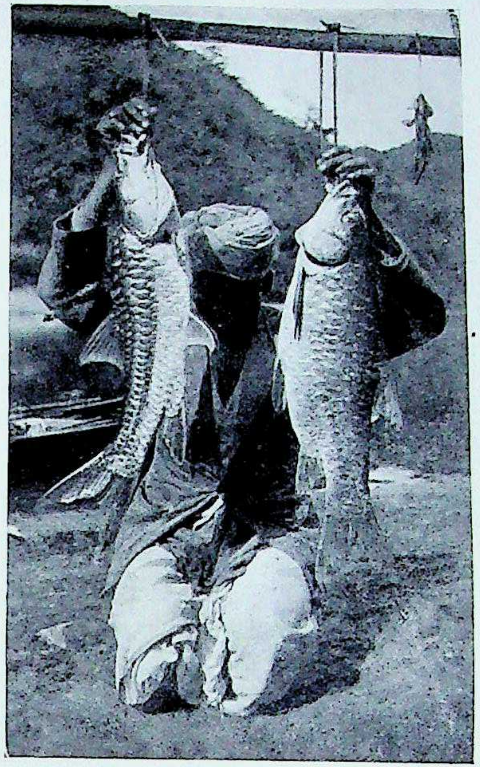
Photos Author

The Boro Hattias.



Photos

Two good mahseer from the Barak.



Author

A mahseer and ' pakhi runga '.

made them particularly pleasant. Found the Tepi' more populated with orange groves on the hill-sides, and cow tracks on the river banks where formerly only game tracks were visible, so took a light camp up the Barak to below Big Gorge which we explored with a view of taking boats through one day. Found we had left all drinks behind at the main camp and having no fish or game, had to open tins for dinner, a rare occurrence on these trips.

I returned to the Tepi' early and landed 3 fish up the little river on the evening rise. W came in later with a 29 lb. Mahseer caught on the troll and had lost another owing to line fouling his boat when landing.

The same evening we were joined by another friend who had come up, travelling most of the night before with a full moon. Our new friend M and I went up the Barak next morning, and had one of the best days I remember for big fish. My diary reads as follows:—

'Went up the Barak and passed him landing a 29 lb. mahseer; as I did so I hooked a 14 lb. mahseer and landed it on the same bank, had a great afternoon coming down and a big fight with a 27 lb. fish, foul hooked on dead bait tackle, which we followed for a mile down stream before landing it. Wife thrilled. I landed another 26 lb. fish and came in with 4 fish, 73 lb; M with 5 fish 64 lbs. W had a blank day up the Tepi' where he was trying a fly and a fly spoon.

Left camp next morning and I was lucky going down to Kommandhur, landing a mahseer at nearly every run, six in all including a Black Mahseer, nothing over fifteen pounds, all caught on a Macdonald Spoon. In the run below camp struck a wonderful rise of 'Butchwa', one of our best eating fish, and landed 12, three over 2 lb. Blackamore Fly, before dark. M, who had stayed another day in our Tepi' camp landed a 56 lb mahseer the heaviest I have known taken out of this river on rod and line. A trip which began badly and ended well. One never knows with fish!

I was on leave in 1929 and decided to try the Jheeri again with B. The fly fishing was good as ever and accidents more frequent than usual. We landed 104 fish and my diary records these accidents:—

'Left a not too comfortable camp where my bed broke. B following with camp. Water looked good, but did not move a fish, till after 11 a.m. when I did well with a Blackamore for 2 hours. B caught me up after lunch as I was landing a 4 lb. mahseer on my trout rod. He had left the boats just behind. I got to camp site at 4 p.m. but no sign, so went back, and met my boatmen who told me that one of B's boats had upset in a rapid. Went on down and collected it at 5 p.m., all very wet. The most serious losses were rice, lamps, shoes, 100 cartridges and batteries for torch: a chapter of accidents as I also broke a rod and lost a good spinning line. Camp pitched well after dark with a small fire; decide to stay tomorrow in this camp and dry things, sending the river chowkedars, who joined us, back to Jheeri Ghat for more rice. I had 6 useful fish, all on fly; B only one, using a fly spoon.

B went off 8 a.m.; I at 10 a.m. after sorting tackle and a bath. Broke my small rod-top in a fish just off camp, not much doing till 12, after which fish were taking well; saw B in the distance and turned. All my fish were Carp, (Bora) caught on a yellow Spider. Boys recovered some of the lost property and a lamp by diving.

I had 11 fish; B had 6, best 3½ lbs.'

B who did not like drinking his evening peg out of my aluminium mugs had carefully brought two glasses in a haversack on his back on a horse. These like other things were lost when his boat upset so had to drink out of my mugs after all! On my way home my diary records more accidents 'went off 8 a.m., started trolling 11 a.m. and immediately landed a 12 lb mahseer. Had a good day with my fly rod afterwards'. B came on with the camp as there were bad rapids and did not get as far as usual. I got back to camp at dark with 10 fish and found B with three, his best a 4 lb carp.

B left early and I followed in charge of *mahl* boats as they took a lot of time getting up rapids. A day full of incident, lost an artificial shrimp in a big fish (English mountings not good enough for strong mahseer), and also broke my old Gamage Split Cane in a fish far too big for the rod; it finished by taking my cast. Otherwise had a good day and eventually got camp pitched 4 hours or so below Jenam Mukh. B had a good day too with various breaks and came in with 5 fish, best 4½ lb. I had 12, best 5 lb. mahseer.

A drop of rain at dawn which soon cleared. B up and I down, after saying goodbye to the river chowkedars who came up from Jheeri Ghat in 2 days with a lamp, more rice etc. to replace what we lost. Both had rather a poor day; B struck rafts coming down and I broke another rod top in a fish on my trout rod.

B came in with 5 fish, best 6 lb; I with 7, best 2½ lb.

B went up and I down, *mahl* boats passed me at 12 at a bad rapid where mine shipped some water and damaged cartridges. Fish rising well. I broke my last fly rod so was reduced to fly fishing with a trolling rod, without much success, fish either coming short or getting unhooked. Also was snagged and broken and lost a good bit of spinning line. Both arrived in camp very tired. B had a wonderful day, 13 fish, best 12 lb, and 2 garganey. I had 6 fish, best 3 lb.'

Up the Barak again in 1931. When on leave I had acquired considerably better tackle, a new Silex, Spinning Rod and Fly Rod bought in England. My companion this time was a young friend, who had not fished before and was unlucky to lose most of his best fish. On arriving at the first rapid by motorboat, where camp had been sent, saw mahseer feeding, and, spinning with a No. 7 spoon landed two before dark. Next day I recorded:—

'Fish still feeding in the rapid at daylight and I landed an 11 lb. mahseer whilst E was shaving, but could not get another. Water very strong in the long dismal reach above Minadhur and sun very hot. Reached Kommandhur, met E and decided to camp early as boats were one hour behind. Few fish to be seen in the good runs so spent most of the afternoon in the shade watching for a feeding fish. Cast a No. 8 spoon over the only one I saw and landed an 8 lb Tiger fish.

Left Kommandhur ahead, had 2 shots at Gharial and hit one hard E caught me up for lunch 1.30. Water very strong and big, trolled and spun, but neither of us could move a fish. Camped about a day below Tepi', may just get there tomorrow. We both shot pigeons.

E went on ahead and I followed, water very strong and too much of it for fish. Caught E up at 12.45, just below the gorge below Tepi' Mukh and had lunch. He had seen wild dogs chase otters into the river, also some Gharial. Arrived at Tepi' Mukh 3-30 and found a decent little sandbank just round the corner for camp.

E went up the Barak and I up the Tepi'. Glad to find some fly water and landed 3 decent fish before dark, *mahl* boats arrived late but managed to get camp pitched. Everyone glad to get into camp for a day or two's rest. Found river chowkidars at Tepi' which also was high but fairly clear. E came in with a pheasant and we both had pigeons.

Went up the Tepi'. Water clear but very high. Did not move a fish on either fly or spoon till 4.15 and finished by being snagged by a good one on my fly rod. Found the Tepi' altered considerably. There is now no waterfall but rapids are bad. Found E in camp after a moderate day up the Big River. Weather extraordinarily warm and, what appeared to be lightning in the sky; most unusual at this time of year. E had 4 fish, best 7 lb and I only two.'

The lovely Tepi' being full of bamboo cutters and rafts, after rather poor days at the mouth moved camp up to just below the Big Gorge. Shot a gharial which managed to get into the water and was picked up next day by my companion, the bullet having pierced the throat; the only one I have ever recovered after it had got into deep water. The local hill people paid us a visit and took away all the meat which by them is looked upon as a great delicacy. I do not think it is generally known that crocodiles are eaten. I once tried a gharial's egg 'never again'! A pleasant enough trip but saw less game than in former years and too many humans, including Lushais who spoke English. At our first camp on the way down an elephant marched through the camp in the night which alarmed the crew somewhat, but went off without doing any damage, when I turned on my torch on him. We landed 35 fish only weighing just under 200 lb and shot one deer only.'

'I was unable to get away for a trip before Christmas, so, having a few days leave at the end of the year, sent my boats up the Jheeri and joined them at Jheeri Ghat with a young friend. We had one boat fitted with an outboard engine but, having broken several propeller pins, decided the river was far too shallow and went to Godown Ghat. The Jheeri at this time is too shallow for boats or fish so made a camp where the track to Macrup and Imphal leaves the plain. My friend returned and I was joined by two others and decided to march to Macrup Ghat with a light camp, about 12 miles over a 1,300 ft. hill, and examine the possibilities of hauling boats over this and coming down the Barak of which the Macrup is a tributary. Somewhere about 1905 two men I knew had conceived the idea of making rafts and floating down through the Hattia Gorges. They took provisions for a fortnight and arranged for boats to meet them below the Hattias up which it was considered impossible to take boats. As they had not arrived in three weeks their boatmen ran out of food and returned for more, eventually meeting them at Tepi' a month after they started. Continually making new rafts had taken longer than they expected and they ran completely out of food, living on monkeys, the only thing they could find to shoot in the Gorges. To lighten their raft they had cached fishing rods and anything they could do without in the jungle. Indians will tell you that something awful will happen to anyone eating monkeys and, within two years of this trip one of these men had committed suicide, the other was in a mental home and their head boatmen and shikari had died of cholera! Incidentally he was the man who landed my first big fish for me. Some time later 2 other men I knew had two dugouts dragged up this track by elephants and got through, but I gathered they did not find it a comfortable trip and were too concerned with getting through to fish much.

With this background and boatmen carrying a light camp we got away about 10 a.m. and reached Macrup, where there is a bamboo suspension bridge, before dark. A fascinating spot and an ideal fly river with quantities of fish to be seen from the bridge. Spent one day there, but only caught an odd fish or two as it was impossible to get up or down far without boats and I came to the conclusion that these must be got there by water. Left next morning and returned to our base camp: my friends sitting over a drink after I had turned in, suddenly woke me up and said they were being stalked by two leopards. Armed with torch and rifle I saw four eyes wandering about at the edge of the water and being somewhat sceptical when I got nearer and turned my torch on, discovered they were two very large civet cats eating refuse, so returned to bed rather annoyed at being woken up.'

This trip convinced me of the impracticability of taking boats over the hills and that they must be got there by water.

The dream of many years at last, after much preparation and pleasant anticipation which preceded these trips by W and myself, seven boats were got off on November 3rd after a cock had been sacrificed and water poured into the prows of the boats, a ceremony always insisted on by the boatmen to propitiate the Gods of the Barak. Boats arrived at the Macrup Bridge on the 15th, having got through the gorges without much trouble with the aid of a long rope. My head man did the 30 miles home by 4 p.m. on the 16th and we got off the stores with 40 carriers by midday 19th. We walked and rode 8 miles in the afternoon to a rest house en route where we stayed the night as often before when fishing the Jheeri.

The following extracts from my diary indicate that our efforts to get our boats above the gorge were amply rewarded :—

'After a comfortable night at the rest house, rose at 5 a.m. and had whole party off by 7-30 and across the Jheeri by 8. Arrived at Macrup 2.45 rather weary. We make the distance a good 14 miles and the height of the highest point 1,300 ft. Found the people left in charge of the camp rather at sixes and sevens but soon straightened things out, and, after a cup of tea, took my light fly rod up the river and landed a nice 3 lb. fish for dinner. W staying in camp to superintend camping arrangements at which he is most expert, so found everything ship-shape on my return.

Had a good night and sent back our porters, some 30 odd, and got up the Macrup with a light boat and 2 men. W, who prefers big stuff, went down to the mouth to fish the Barak. Left Okai my head shikari and boatmen to divide the stores up so that we could leave what was not required with the river chowkedars and take a light camp when we moved. Had a first class day with my fly rod, 11 good fish weighing 28 lb. and a 10 lb. mahseer spinning, lost one only. Got back 5 p.m. and found W with 3 good fish caught on the troll in a pool at the mouth. He had been broken and lost two more and 50 yards of line. His 3 fish weighed 43 lb. Had a round table conference at night and decided to move only as far as the Macrup mouth next day and not attempt to reach Hattias as long as fish were taking well higher up as I had previously arranged for two young friends to take the boats back through the gorges, fishing on the way.

Made a late start from Macrup Bridge as all stores had to be sorted, and only necessities taken. Two more carriers returned and chowkedars were left in charge of the balance. Water very low in the Macrup, boats had to be dragged down rapids. I arrived at the mouth 12.15; W at 12.30; *mahl* boats not till 4 p.m. Little good fishing water en route. Had lunch and immediately caught a 32 lb. mahseer spinning on my light rod and No. 7 spoon which took some time to land. W went up the Barak and caught two good fish on the troll and another off camp as the boats arrived. Made a late camp at Mukh and everyone rather weary. W's fish weighed 35 lb, 22 lb and 4 lb. Mine 32 lb with 2 smaller caught on fly.

Had a good night in spite of camping late, took some time fixing up heavy tackle and putting W in the way of using a spinning rod, on which he subsequently caught a fish. I landed a small mahseer off camp while trying rods and then went off up the Barak to explore some new country. Got another fish very soon spinning, also a gharial. After that fish went off in the Upper Gorges which much resemble the Hattias on a smaller scale and finish with a waterfall beyond which it is impossible to take boats. W had a fair day downstream, was broken by a big fish, saw nothing to shoot except a deer which escaped wounded. He had 2 fish 12 lb; I had four 17 lb.

Went downstream 8.45 a.m. and never had a dull moment all day, no luck trolling which is not my strong suit and several accidents spinning, losing 2 big fish on light tackle, one of which broke me at the top of a rapid, another slipped the hooks after being played 10 minutes. I lost 3 spoons and landed 6 small fish only. Shooting was more successful, killed a fine stag and the biggest red dog I have ever seen both at about 100 yards, so with a boat loaded to the gunwale returned slowly to camp.

W went upstream and did not get a fish, but, trolling past camp, hooked and landed a 24 lb. mahseer. I had 6 fish 3–4 lb. each. Two Kookis who visited us in the morning and were given tea, returned in the evening with eggs. Gave them 2 fish and the carcase of the wild dog, which stank the whole camp, as they assured me it was far better eating than venison! We sent them across the river in a boat where they squatted on a sandy spit, cooked and ate the dog, also the entrails of the stag, and seemed to enjoy themselves immensely.

Sorted tackle and went upstream rather late after catching a couple of Chilwa for bait. Barak upstream very short as one soon got into the gorges and waterfall. Hooked a good fish trolling on the way up, but it took me straight into a sunken tree and tied up the line where I had to watch it unhook itself in clear water, but managed to rescue my spinner. Could not move anything spinning so returned to camp for lunch and went up the Macrup with my fly rod where I got two decent fish, some pigeons and a monitor lizard. W came in after an excellent day downstream with the best fish so far, a 36 lb mahseer several small ones, 2 caught spinning: seven in all.

Started the day by catching Chilwa for bait and my bearer finished it by catching Butchwa for dinner on a night line. Went downstream and had very few dull moments. Got a couple of fish trolling, trying for a big one which I eventually got into at 11.30, was taken over a rock ledge and broken losing a new trace and spinner. As I was repairing tackle saw a fine sambar stag crossing a rapid below me. Had a shot at 100-150 yds. and missed in front, but got him as he was galloping back to the jungle.

After towing it up the rapid got it into the boat and it took my crew and self all our time to get to camp upstream by 5 p.m. Met W just below camp; he had been exploring the gorges up above and, though he had no luck with fish he had shot two duck and a pheasant. I had 2 fish 5 and 4 lb. We seem to be more successful with gun than rod. No end of food however, camp absolutely stinking with smoked fish and meat which the crew will take home with them. My bearer caught another good Buthcwa at 7-30 p.m. for dinner. We are leaving tomorrow for a stiff pull up the Macrup where the water is low.

Returned to Macrup Bridge as the water in the Macrup was falling rapidly and is much lower than in any normal year and difficult for heavily laden *mahl* boats. Also we had done very well at Macrup Mukh and thought it well to leave well alone and get the meat and fish to the road to be dried, with a day in hand to sort the stores for E and R who are taking the boats home through the Hattias. I started the day well by landing a 12 lb mahseer off camp on a homemade spinning rod. Our Kooki friends turned up and were given the balance of the sambar meat with which they were delighted. I left ahead of the *mahl* boats and collected 4 decent little fish spinning as they were not taking a fly in the morning. Got to Macrup Bridge 3 p.m. closely followed by *mahl* boats and saw camp started. Went up and got 3 fish on a fly after 4 p.m. W went down the Barak hoping to get another big one but had no luck and a hard pull up in the afternoon with no time to fish.

Very comfortable camp, baths, etc. with our own fish and pheasant for dinner. I think someone has been at the brandy bottle!

Weather turned rather cold; water in Macrup very low and mostly gin clear. W went off upstream after I had fixed him up with spinning and fly spoon tackle. I left ½ hour later but could not move anything either spinning or with fly till 11-30., then by careful fishing, sitting low in the boat, had some good sport with a 5 lb. carp on my trout rod. Had lunch in a big gorge which looked like fish, but nothing doing and fish went clean off as soon as the sun got off the water. W caught me up 3 p.m. having gone as far up the Macrup as he could get his boat; he had 2 fish, caught spinning.

Macrup, last day. Left early upstream for a short day, water far clearer and dropping rapidly. W came up and we lunched together. Nothing doing in the morning; worked hard with the fly but fish kept coming short and only got three just before returning to camp 3-30 p.m. We then got down to sorting things and making a list of what we were leaving for E & R.'

On Nov. 30 left our camp at Macrup Bridge standing for E and R who brought the boats back without any trouble, catching a few fish en route.

Our total catch in a week's fishing was 68 fish weighing 362 lb, the best for weight of any trip I did, as well as samples of nearly all the game to be found in these parts. We decided to do the round trip next year and explore a new river, the Irung.

(*To be continued*)

SURVEY OF ECONOMIC VEGETABLE PRODUCTS OF JAMMU AND KASHMIR

1. SINDH FOREST DIVISION

BY

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(*With a sketch map*)

The Sindh Forest Division lies to the north-east of Kashmir valley between lat. 34° 7′ & 34° 37′ N. and long. 74° 36′ E. Its boundaries touch the outskirts of Srinagar city and Baramulla Tehsil of Kashmir Province.

The area is bounded on the north-east by the great Himalayan Range which separates the water-sheds of the Kishanganga river from those of Jhelum River. This division includes Gurez, Dras and Warwan *illaqas* and areas right up to Gilgit and Kargil on the north, and the Dachigam Rakh and the Dara nala right up to Srinagar municipal limits and the Jhelum river on the south. It is separated from the Kamraj division in the west by a chain of hills starting from Miyanigul and sweeping gracefully down to the pyramidal hillock of Baba-Shukar-Din on the banks of Wular Lake

The main topographical features are the great Himalayan Range in the north-east and the numerous marshes and lakes in the south, with two main series of mountains running from the east to west and enclosing the Sindh valley. The northern range branches off near Barihal into two main ridges; one of these extends right upto Kazinag and the other with its everlasting snows of the Harmukh (16,903 ft.) ends at the domeshaped hills of Manashbal. From these slopes, and especially from the top of Harmukh, numerous streams start and radiate in all directions and eventually empty themselves into the Wular or into the Sindh river.

The jurisdiction of the Sindh Forest Division has lately been extended from the Kamri and Burzil passes to the inner dry valley of Astore right up to Bunji. Herein lies the peak of Nanga Parbat (26,182 ft.). This inner dry valley is fed by the Astore river and many other streams coming from the glaciers of Nanga Parbat and Burzil mountains. The Astore river pours into the Indus at the Partap Bridge near Bunji. The major part of this area is a dry rocky tract with sand in the valleys and of a bleak and rugged appearance.

The elevation ranges from 5,200 ft. at Zurimanz on the Wular to 26,182 ft. on the Nanga Parbat. The forests lie mainly on the northern and eastern aspects of the valleys at altitudes between 6,000 to 11,000 ft.

This is the richest forest division of Kashmir well known for its natural resources because of its varied climate and abundance of minor forest products; Rhubarb, Colchicum, Aconites, Belladonna, Saussurea, Podophyllum, Male-fern, Juniperus, Artemisia, Valerian and many other plants of economic importance are here found in profusion. The area is not only rich in common herbs but also contains some rare plants such as Asafoetida and *Pinus gerardiana* which are not found in any other part of Kashmir.

In order to explore the possibilities of the exploitation of some of these common economic plants and to find some other plants of interest, a botanical excursion was arranged from Bandipore to Astore and back and from Srinagar to Vishnu-Sar via Sonemarg and back in the summer of 1946. The area traversed is shown in the attached map and represents the major part of the tract covered.

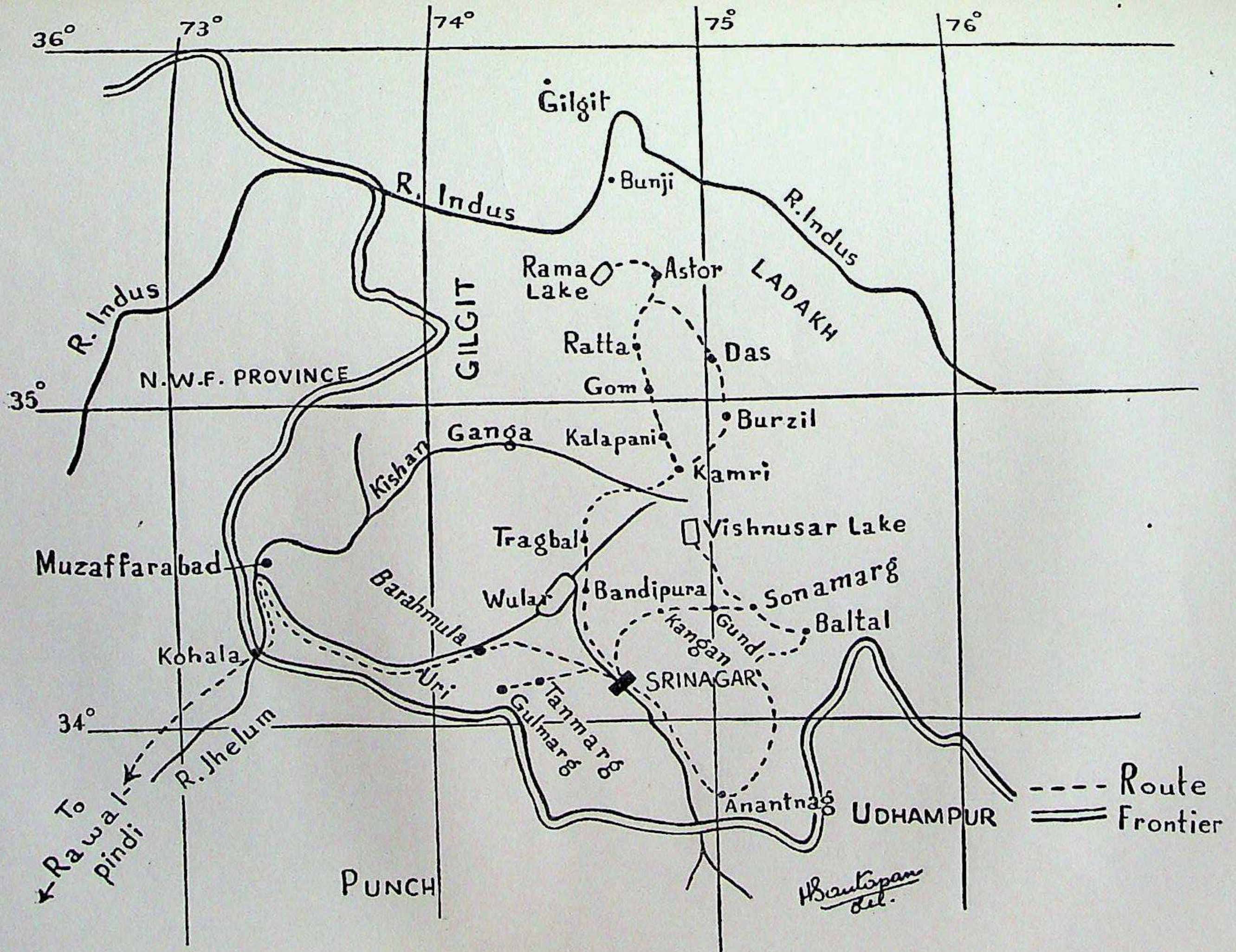
The party consisted of Dr. R. R. Stewart, Principal, Gordon College, Rawalpindi, Mrs. Stewart, Prof. Nasir of Gordon College, Dr. Stuenz and his wife. The authors acknowledge with thanks the help received from Dr. Stewart and Prof. Nasir by way of determination of plants collected. The other members of the party were also interested in natural history, particularly in birds, etc. They all contributed towards the information recorded here.

Bandipore is connected with Srinagar by a 34 miles long, direct motor road and also by the river Jhelum and the Wular Lake, and from here starts the road to Gurez and Astore valleys. Chatternar, situated at the head of the Wular Lake commands a wonderful view of the lake which supplies the adjoining areas with such economic products as *Nelumbium speciosum, Trapa bispinosa* and *Typha,* the cat-tail which is used in the manufacture of the mats so largely used locally. This grass-like plant and other aquatic weeds are harvested from the Wular Lake for use as fodder and manure. The Forest Department maintains the Ningli plantation for raising different species of willow for commercial purposes. Bandipore has a vegetation similar to the Dal Lake near Srinagar. Trees of *Punica granatum, Zizyphus jujuba, Salix* sp., *Morus alba*, etc. and several other species occur in this area. Rice, wheat, barley and maize are cultivated around Bandipore.

As the route ascends from Bandipore to Tragbal, the forest flora of this region comes into evidence. The maize and rice fields are left behind and *Pinus excelsa* with its undergrowth of *Stipa sibirica, Viburnum nervosum* and *Parrotia jacquemontiana* are met with. The timber from *Pinus excelsa* is very useful and contributes largely to the State revenue. *Stipa sibirica* is a grass poisonous to livestock containing cyanogenetic glucosides. *Parrotia jacquemontiana* (Hatab) is a common slow growing tree or large shrub yielding a wood useful for the manufacture of tool handles and also for fuel.

From Bandipore there is a steep ascent of about 12 miles to Tragbal. It commands a beautiful view over the river Jhelum as it runs into and emerges out of the Wular Lake, and also of the adjoining valley surrounded by the snow covered range of the Pir Panjal.

Tragbal (9,000 ft.) is a small meadow at the base of the Rajdhani Pass which is nearly 12,000 ft. high. *Abies pindrow* is the common fir growing here along with broad-leaved trees like *Juglans regia, Betula utilis, Prunus padus, Acer pictum* etc. The road passes through



36°
73°
74°
75°
76°
35°
34°
Gilgit
Bunji
R. Indus
R. Indus
R. Indus
Rama Lake
Astor
LADAKH
GILGIT
Ratta
Das
Gom
Burzil
N.W.F. PROVINCE
Kishan Ganga
Kalapani
Kamri
Vishnusar Lake
Tragbal
Muzaffarabad
Barahmula
Wular
Bandipura
Sonamarg
Baltal
Gund
Kangan
Kohala
Uri
SRINAGAR
Tanmarg
Gulmarg
R. Jhelum
To Rawal-pindi
Anantnag
UDHAMPUR
PUNCH
Route
Frontier
H. Santapau del.

JAMMU AND KASHMIR

forests of *Pinus excelsa* on both the eastern and southern aspects of these mountains.

The ascent to Rajdhani Pass leads through beautiful open meadows on which amongst many other plants are found *Verbascum thapsus*, as well as *Jurinea macrocephala* (Dhup) used commonly as incense.

Some trees of *Pinus excelsa* were seen attacked by *Arceuthobium minutissimum*, a minute parasitic plant which kills the trees. *Sambucus wightiana*, commonly known as 'faklua', due to its unpleasant smell is very common in the tract. *Impatiens roylei, Artemisia grata, Senecio jacquemontiana, S. chrysanthemoides, Lindefolia longiflora* and *Cynoglossum* sp. were also very common on both sides of the path leading to Rajdhani Pass.

The top of Rajdhani or Rajdhiangan is an open meadow. Here at about 12,000 ft. is a junction of different routes coming from Gilgit, Bandipore, Viji and Basam Gali. *Pedicularis* sp., *Chaerophyllum* sp., *Saussurea lappa, Polygonum alpinum, Phlomis bracteosa, Euphorbia wallichii, Saxifraga ligulata, Sedum* sp., *Achillea millefolium*, and *Carum carvi* were among the common plants seen here.

From Rajdhani the road zigzags down through commercial and non-commercial forest belts of *Abies pindrow* and reaches Koragbal and on to Kanzalwan where the river Kishanganga turns and flows towards Keran Division. The forest flora along the roadside is rich and includes the plants mentioned above and many more.

At Koragbal *Artemisia brevifolia* Wall. is seen growing wild in profusion. This plant is common in the Gurez and Rattu valleys and it is annually collected for the manufacture of santonine at Baramulla. A stream running from Viji (13,000 ft.) to Koragbal (8,000 ft.) and flowing past its rest house was also explored, and among others *Dryopteris odontoloma, Aileantum patatum, Valeriana wallichi, Achillea millefolium, Orobanche* sp., *Saussurea lappa* and many other plants mentioned in the appendix were collected.

The main road runs along the river upto Badwan and Gurez valley 8,000 ft. and then crosses the river Kishanganga. The Gurez valley is a narrow strip surrounded by hills with a meadow and river Kishanganga running through and *Populus alba* and *P. ciliata* growing in abundance. Visitors often camp in this area and enjoy trout fishing in streams maintained by the Forest Department. The Gurez valley is surrounded by hills on all sides and is rich in vegetation. *Sambucus wightiana, Brunella* sp., *Swertia* sp. and *Jaeskia gentianoides* grow profusely here. *Euphrosia officinalis* and *Senecio thomsoni* are common in Badwan and so also is Red clover (*Trifolium* sp.) which is good fodder for livestock. Along the road from Badwan to the Kamri Rest House (9,000 ft.) some arable fields are seen near Dawar, Churwan and Kamri villages where *Fagopyrum esculentum, Solanum tuberosum* and barley are cultivated by the local people for food.

At Churwan a path leads to the Talil valley which is visited by a large number of shepherds with large flocks of sheep. Adjacent to Talail valley lies Vishnusar which is easily accessible via Sonemarg. In the fields and round about the main route *Carum carvi* (Zira) of good quality with strong aroma commonly grows, and this is harvested for marketing in Kashmir where it is well known as 'Zira of Gurez'.

As the road to Kamiri ascends along the river Kishanganga the belt of *Abies pindrow* is left behind and scattered trees of *Juniperus macropoda* are seen commonly up to the rest house at the Kamiri Pass. *Juniperus* forms a small thin forest crop in this area. Its seeds yield the essential oil which is used in the preparation of gin and for flavouring liquors. The wood can best be utilized for the manufacture of pencils. *Prangos pabularia* and *Aconitum chasmanthum* occur in fairly large quantities. *Prangos* is aromatic and locally serves as a good dry fodder for livestock in winter. *Aconitum chasmanthum* root finds a good market as an Indian substitute for the officinal Aconite. *Artemisia brevifolia* is abundant in this area and is collected commercially. *Codonopsis* sp., *Nepeta* sp. and *Heracleum* sp. were also common in this part of the tract. Kamiri rest house at 10,000 ft. is situated amidst fir and *Betula utilis* (Bhojpatra) trees.

Kamiri Pass is about 6 miles from this rest house and the bridle path has profuse vegetation right up to the top. Among others which have been recorded near Rajdhani, *Valeriana pyrolaefolia*, *V. hardwickii*, *Aquilegia fragrans*, *Polygonatum geminifolium*, *Onosma echiodes*, *Thalictrum minus*, *Sedum* sp. *Saxifraga* sp. *Paraquilegia* sp., *Primuloides*, *Senecio jacquemontiana*, *Artemisia parviflora*, *A. laciniata*, *Saussurea lappa* and other species of *Saussurea*, *Picrorhiza Kurrooa*, *Macrotomia benthami*, *Juniperus squamata*, etc., need mention. A detailed list is appended.

From the Kamiri Pass on clear days an excellent view of Nanga Parbat (26,740 ft.) to the north and Harmukh (16,700 ft.) to the south is obtained.

Kamiri Pass is the boundary line of the Gurez range and as the descent begins on the other side of the pass we enter the Astore range. From the pass there is a zigzag descent of 7 miles to Kalapani Rest House. *Aconitum heterophyllum*, *A. chasmanthum* and *Scrophularia griffithii* are common and so are *Pedicularis* sp. and *Senecio chrysanthemoides*, etc. This side of the pass presents chiefly rocks with only humble vegetation over it; hence the name Kala Pani. The trees of *Betula utilis* are only seen in small patches along with fir trees.

Kalapani (10,000 ft.) is rich in alpine flora. The water here contains silica and needs filtration before it can be used for drinking purposes. There is no village near Kalapani except at Chachri-Kadal about 8 miles distant. *Heracleum* sp., *Lindelofia longiflora*, *Cynoglossum*, *Cerastium*, are common near the rest house. *Artemisia brevifolia* is not seen from Kamiri Rest House to Chachri-Kadal but it makes its appearance only beyond Chachri-Kadal right upto Rattu and Rampore where it grows profusely. That it does not grow between Kamiri and Chachri-Kadal may be due to the fact that it is more xerophytic; near the pass there is much moisture until July. The route leading from Kalapani to Rattu passes through barren areas excepting near a few villages at Shankargarh etc., where wheat and barley are cultivated. *Hippophaë rhamnoides*, *Salix* sp. and *Artemisia brevifolia* are common all along the route. From Shankargarh again the peaks of Nanga Parbat are visible. The path leads along with Chachri-Kadal stream which later on joins the Astore river.

Rattu is one of the chief centres for the collection of *Artemisia*. *Pinus excelsa* is seen growing at Rattu. On the plateau at Rattu

Gurez Valley—Artemisia growing area.

Photos Author

A view of Nichnai (12,000 ft.).

Cimicifuga foetida (flowering plants).

Phytolacca acinosa (fruiting) grows wild and is used for adulterating Belladonna roots and leaf.

Photos L. D. Kapoor

(Cantt. area) *Scabiosa* sp. is very common. Rattu is mostly sandy and barren except for *Artemisia* and *Scabiosa.* The height of Rattu is 6,000 ft. and flora is representative of the inner dry valleys of the Himalayas.

As the route proceeds from Rattu to Rampore along the river, *Melilotus alba, Artemisia brevifolia, Hyoscyamus niger* and cultivated fields of barley, maize and potatoes are commonly met with. Scattered trees of *Pinus excelsa* and *Abies pindrow* are also found. Rattu *illaqa* is a favourite hunting place for ibex, etc. Rampore is about 10 miles from Rattu and here too the collection of *Artemisia* is carried on vigorously by the santonine manufacturers.

From Rampore a footpath leads to Tarshing and Rupal-nalla at the base of Nanga Parbat. The snow clad peaks of Nanga Parbat namely Dameir and Rakhiote present a marvellous view when the morning rays of the sun fall on them or when the light of full moon makes them glow.

Salvia glutinosa, Chenopodium botrys and *Nepeta* sp. and *Datisca cannabinna* were commonly seen while trekking from Zaipur village across the snout of the Nanga Parbat glacier to Tarshing village situated just at the base of Nanga Parbat and protected from glaciers by lateral moraines. Ice cold water oozes out at various places in this village obviously as a result of seepage from the glacier separated by the moraines. The Rupal-nalla beyond Tarshing, similarly presents beautiful views of the glaciers.

The commonest plant here is *Artemisia.* It is a very hardy weed and can stand the cold winds blowing from Nanga Parbat and also the drought in summer. Tarshing stream contains dirty glacier water and is utilised for irrigation purposes at some places. The water here is lacking in iodine and it generally causes goitre in the *illaqa* where it is used for drinking purposes.

The road leading from Rampur to Astore along the Tarshing nalla (later on known as Astore river when streams from Kamiri and Brizil meet at Gorikot) presents the inner dry valley vegetation. A thistle with globeshaped heads and *Anaphalis* and *Zizyphus* sp. are amongst the common vegetation on this route. At Gorikot it meets the main road from Burzil to Gilgit.

From Gorikot to Astore trees of *Pinus gerardiana* and *Juniperus macropoda* are again met with. This *illaqa* is otherwise sandy except at places where some irrigation is made possible and cereals are cultivated. It is very thinly populated; the inhabitants are related to the Chillas tribes.

Astore, a small village and the district headquarters, is situated at an altitude of 7,000 ft. above sea level with very scanty cultivation. *Pinus gerardiana* and *Juniperus macropoda* are used for house building as well as for fuel. There is no proper forest protection in this *illaqa.* Asafoetida (*Ferula narthex*) which is widespread at Harchoo beyond Astore, is allowed to go waste without extraction of its gum resin (Hing). *Abies pindrow* is found scattered here and there. Grape vines, apples and apricots are also grown here in small gardens.

At a distance of about 7 miles from Astore is situated Rama Lake. It is a small glacier lake at the base of Nanga Parbat on the northern side of Tarshing.

Juniperus recurva is very common at Rama. Along the path from Astore to Rama, *Hippophaë rhamnoides, Astragalus strobiliferus, Salix* sp. and *Pinus excelsa* were seen. *Pyrola rotundifolia* was also collected at Rama.

Pinus gerardiana seeds provide the 'Jalgoza' of commerce but they are not collected by the inhabitants for commercial purposes. *Juniperus macropoda* can yield a good wood for the manufacture of pencils, but the transport cost would be so prohibitive that it is not an economical proposition to exploit it.

Asafoetida (*Ferula narthex*) is common, and this is the only place in Kashmir where this plant is found in abundance. The gum resin popularly known as 'Hing' is commonly used in medicine and also for flavouring food articles. If exploited it would provide additional income to the inhabitants.

From Astore the party returned via Burzil pass (13,500 ft.). The track upto Gorikot from Astore was the same already trodden. From Gorikot to Godai along the Burzil stream the road is sandy for the major part. *Astragalus strobiliferus* and *Dephine oloides* is commonly seen here. *Astragalus strobiliferus* can yield the Indian substitute of the officinal gum Tragacanth. *Dephine* is a poisonous plant. Bupand valley near Godai is reported to be famous for big game and it is also reputed to be rich in medicinal plants such as *Saussurea lappa, Valeriana,* and *Angelica glauca* etc.

Passing through Khiram and Dass small villages where *Artemisia laciniata, A. amygdalina, A. parviflora* are growing wild, the route leads to Chillam Chowki. Hardly any growth except *Betula utilis, Salix* sp., and juniper trees are seen about here. The road further leads to Sirdar Kothi.

This part of the valley is quite rich in vegetation. Plants such as *Aconitum heterophyllum, A. chasmanthum, Pedicularis, Senecio chrysanthemoides, Corydalis* sp. were commonly seen. Most of these plants have been observed at Kamiri and Kalapani also.

From Sirdar-Kothi there is a gentle ascent to Burzil top at 13,800 ft. above sea-level. The top commands a good view on all sides. The snow clad peaks around add to the grandeur. As the road climbs down to Burzil Chowki it opens out into an area bedecked with the same alpine flora which we saw at Kamiri. From Burzil Chowki the belt of *Betula utilis* begins down to Pushwari where *Abies pindrow* appears. *Artemisia brevifolia* which has been left behind at Godai again appears at Minimarg. *Datisca cannabiana* was observed in many patches between Burzil Chowki and Minimarg. *Impatiens royleana* was in abundance near Minimarg and lower down the valley. The river Kishanganga passes by Minimarg and a road leads to Skardu from this junction. Pushawari which is the next halt is a small village surrounded by fir forests. *Angelica glauca* (chora) is found here in abundance. Its roots contain an essential oil. From Pushawari on to Dawar and Badwan the artemisia is common.

Behind Badwan Rest House a forest road leads to Viji and to Bandipore. This area is rich in Kuth and other medicinal plants mentioned previously and the forest contractors extract drug plants from this side in fairly considerable quantities.

The list of plants collected is given in the appendix. It is in no way an exhaustive list because only flowering plants at the time of our tour were collected. Medicinal plants such as *Belladonna, Lavetera, Podophyllum, Saussurea* etc. are annually collected from different localities of this valley by the Forest Department.

A motor road runs through the Sindh valley along the Sindh river from Srinagar to Sonemarg which is a developing health resort and attracts visitors in good numbers. This is the main route leading to Ladakh and Kargil in the north. The motor road now runs through Woyil, Kangan, Gund, Sonemarg and upto Dras. The land along the river is cultivated with maize, barley and wheat up to Gund. The local people at Sonemarg grow *Fagopyrum*, potatoes and barley. The average altitude ranges from 9,000 to 10,000 ft. at Sonemarg. Thajiwas provides a beautiful camping ground near Sonemarg at the base of glaciers. The streamlets from the Amarnath glaciers and Baltal feed the big Sindh stream.

The common plants collected on this way are also given in the appendix. A path leads from Sonemarg to Vishnusar lake which then continues to the Tilel valley and meets the Gurez valley on the north.

There is a steep path up to Sari village. *Sambucus wightiana* is common here. The path further leads to Nichni. It is surrounded by rocky mountains on all sides and a small stream flows by. On the way and passing through forests, plants like *Meconopsis aculeata, Aconitum laevi, Saussurea lappa, Salvia hiana, Artemisia grata* etc., were common. The Nichnai Pass is about 13,500 ft. The path leads to Vishensar at the base of Harmukh. Here are vast meadows where livestock graze.

Vishensar is a glacier lake at the base of the snow clad peaks. There is a foot path to cross this hill leading to Gangabal Lake which can also be approached via Kangan. *Juniperus recurva* and *Rhododendron* sp. are common in this region; they are only used as fuel by the shepherds and the graziers. *Stipa sibirica* is a common grass from Sonemarg to Baltal. It contains cynogenetic glucoside and is poisonous to livestock.

Sindh Forest Division abounds in economic plants. It is believed when more detailed and exhaustive excursions in different seasons are organised this list may be greatly increased. But it will suffice as a basis for future work.

Our thanks are due to Father H. Santapau for going through the manuscript and for his many helpful suggestions.

SYSTEMATIC LIST OF THE PLANTS OF SINDH DIVISION

In the following list plants are arranged according to the order of the families of Hooker's Flora of British India. The scientific name of the plant is given first in every case, then follows the synonym in a number of cases, lastly the exact localities where the plants have been found are mentioned.

RANUNCULACEAE

1. *Aconitum chasmanthum* Stapf ex Holmes.
   Kamari, Gurez, Burzil.
2. *Aconitum heterophyllum* Wall.
   Kamri, Kalapani, Burzil.

3. *Aconitum laeve* Royle.
Baltal, Koragbal.

4. *Aconitum violaceum* Jacq.
Sardar Kothi.

5. *Actaea spicata* Linn.
Below Razdhanigan.

6. *Adonis chrysocyathus* Hook F. & T.
Sonmarg, Nichnai.

7. *Anemone polyanthes* D. Don.
Kamri.

8. *Anemone rupicola* Camb. var. *sericaea* H. & T.
Kamri.

9. *Anemone tetrasepala* Royle.
Nichnai.

10. *Aquilegia fragrans* Benth.
Nichnai.

11. *Aquilegia jucunda* Fisch. & Mey.
Kamri.

12. *Caltha palustris* Linn. var. *alba* Jacq
Sonmarg, Nichnai.

13. *Clematis graveolens* Lind.
C. connata DC. *grata* Wall.
Astore. Gurikot.

14. *Clematis orientalis* Linn.
Koragbal.

15. *Delphinium ranunculifolium* Wall.
Sonmarg.

16. *Paeonia emodi* Wall.
Gurez.

17. *Paraquilegia grandiflora* Drum. & Hutch.
Kamri Pass.

18. *Ranunculus hirtellus* Royle.
Kalapani.

19. *Ranunculus laetus* Wall.
Baltal, Koragbal.

20. *Ranunculus munroanus* J. R. Drumm.
Kamari Pass.

21. *Ranunculus trichophyllus* Chais.
R. aquatilis var. *trichophyllus* H. & T.
Rattu.

22. *Thalictrum cultratum* Wall.
Kamri.

23. *Thalictrum foetidum* Linn.
Gurez.

24. *Thalictrum minus* Linn.
Gurez.

25. *Trollius acaulis* Lindl.
Nichnai.

BERBERIDACEAE

26. *Podophyllum emodi* Wall.
Sonamarg, Serrai, Gurez.

PAPAVERACEAE

27. *Meconopsis aculeata* Royle
Nichnai, Razdhanigan.

CRUCIFERAE

28. *Arabidopsis himalaica* Edgew. O. E. Schula.
Sisymbrium himalaicum H. & T.
Baltal.

29. *Arabidopsis mollissima* O. E. Schulz.
Sisymbrium mollissimum C. A. Mey.
Pushwari.

30. *Arabidopsis thaliana* Schur.
Sisymbrium thalianum Gay & Monn.
Pushwari.

31. *Arabis glabra* Crantz.
Koragbal.

32. *Arabis tenuirostris* O. E. Schulz.
Rattu.

33. *Barbarea intermedia* Bureau.
Gurez.

34. *Barbarea vulgaris* Br.
Kamri.

35. *Brassica napus* Linn.
Gurez.

36. *Cardamine impatiens* Linn.
Baltal.

37. *Chorispora sabulosa* Camb.
Nichnai.

38. *Draba alpina* Linn.
Draba oreades Schrenk.
Kamri.

39. *Draba lanceolata* Royle.
Kamri.

40. *Draba nemorosa* Linn.
D. muralis Linn.
Tarshing.

41. *Draba obscura* Dunn.
Aphragmus obscurus Dunn O. E. S.
Kamri.

42. *Draba petraea* Baung.
Nichnai.

43. *Erysimum melicentae* Dunn.
Thlaspi cochlearioides Hk. f. & T.
Baltal, Zozila.

44. *Iberidella andersoni* Hook. f. & T.
Nichnai.

45. *Nasturtium palustre* DC.
Astore.

FUMARIACEAE

46. *Corydalis thyrsiflora* Prain.
Kamri.

47. *Corydalis govaniana* Wall.
Kamri.

48. *Corydalis ramosa* Wall.
Kamri, Sardarkothi.

VIOLACEAE

49. *Viola sylvatica* Fries.
Koragbal.

50. *Viola odorata* Linn.
Gurez.

CARYOPHYLLACEAE

51. *Arenaria Kashmirica* Edgew.
Rampore.

52. *Arenaria parviflora* Benth.
Rampore.

53. *Arenaria neelgerrensis* W. & A.
Kamri.

54. *Cerastium dahuricum* Fisch.
Kamri.

55. *Cerastium trigynum* Villars.
Koragbal.

56. *Caucalis latifolia* Linn.
Kamri.

57. *Lychnis nutans* Benth.
Kamri.

58. *Lychnis cachemeriana* Royle.
Koragbal.

59. *Silene inflata* Sm.
S. venosa Gilib.

60. *Silene Kunawarensis* Benth.
Rattu.

61. *Silene tenuis* Willd.
Kamri.

62. *Silene moorcroftiana* Wall.
Shankergarh.

63. *Stellaria crispata* Wall.
S. monosperma Buch. Ham.
Baltal.

64. *Stellaria cuspidata* Willd.
S. subumbellata Edgew.

65. *S. bulbosa* Wulf.
S. Davidi Var. himalaica French.
Kamri.

HYPERICACEAE

66. *Hypericum perforatum* Linn.
Rattu.

MALVACEAE

67. *Lavatera kashmiriana* Camb.
Gurez.

GERANIACEAE

68. *Geranium pratense* Linn.
Vishensar.

69. *Geranium Kishtvariense* Knuth.
Kamri.

70. *Geranium rectum* Trauty.
G. wallichianum D. Don.
Kalapani.

RUTACEAE

71. *Skimmia laureola* Hk. f.
Kangan.

BALSAMINACEAE

72. *Impatiens brachycentra* Kar. & Kir.
Sonemarg.

73. *Impatiens edgeworthii* Hook. f.

74. *Impatiens Flemingii* Hk. f.
Impatiens Roylei Walp.
J. glandulifera Royle.
Koragbal.

75. *Impatiens thomsoni* Hk. f.
Koragbal.

CELASTRACEAE

76. *Euonymus hamiltonianus* Wall.
Kamri.

RHAMNACEAE

77. *Rhamnus prostrata* Jaq.
Kamri.

78. *Rhamnus virgata* Roxb.
Chatternar and Haran.

SAPINDACEAE

79. *Acer caesium* Wall.
Baltal.

80. *Aesculus indica* Hiern.
Kangan.

PAPILIONACEAE

81. *Astragalus bicuspis* Fisch.
Rattu.

82. *Astragalus himalayanus* Klotz.
Koragbal.

83. *Astragalus longifolius* Lam.
A. longicaulis Barker.
Kamri.

84. *Astragalus orobrephes* W. Smith.
Astore.

85. *Astragalus oplites* Benth.
Pushwari.

86. *Astragalus peduncularis* Royle.
Astore.

87. *Astragalus rhizanthus* Royle.
Shankergarh.

88. *Astragalus royleanus* Bunge.
Pushwari to Gourikot.

89. *Astraglus strobiliferus* Royle.
Astore.

90. *Astragalus webbianus* R. Garh.
Gudei.

91. *Cicer soongaricum* Steph.
Pushwari.

92. *Colutea nepalensis* Sims.
Astore.

93. *Hedysarum astragaloides* Benth.
Rampore.

94. *Lotus corniculatus* Linn.
Koragbal.

95. *Medicago falcata* Linn.
Kamri, Gurez.

96. *Oxytropis thomsoni* Benth.
Kamri.

97. *Trigonella Emodi* Benth. var. *podperae* Sirjaev.
Gudei.

98. *Vicia faba* Linn.
Rampore.

99. *Vicia tenuifolia* Roth.
Shankergarh.

ROSACEAE

100. *Agrimonia pilosa* Ledeb.
Gurez and Koragbal.

101. *Alchemilla vulgaris* Linn.
Kamri Pass.

102. *Cotoneaster microphylla* Wall.
Rattu.

103. *Fragaria vesca* Linn.
Baltal, Sonamarg.

104. *Geum elatum* Wall.
Vishensar, Nichnai.

105. *Geum urbanum* Linn.
Vishensar.

106. *Potentilla argyrophylla* Wall.
Badwan.

107. *Potentilla curviseta* Hook. f.
Kamri.

108. *Potentilla desertorum* Bunge.
Badwan.

109. *Potentilla fragarioides* Linn.
Baltal.

110. *Potentilla gelida* C. A. Meyer.
Rampore.

111. *Potentilla kashmirica* Hook f.
Rampore.

112. *Potentilla leucochroa* Lindl.
Gurez.

113. *Potentilla multifida* Linn.
Rattu.

114. *Potentilla nepalensis* Hook.
Badwan.

115. *Potentilla reptans* Linn.
Pushwari.

116. *Potentilla sibbaldi* Haller. f.
Kamri Pass.

117. *Potentilla supina* Linn.
Kamri.

118. *Prunus jacquemontii* Hk. f.
Rampore.

119. *Rosa macrophylla* Lindl.
Baltal.

120. *Spiraea affinis* R. N. Parker.
Tarshing.

SAXIFRAGACEAE

121. *Parnassia affinis* Hk. f. and T.
Rampur.

122. *Ribes nigrum* Linn.
Rama, Astore.

123. *Ribes orientale* Desf.
Rampore.

124. *Saxifraga androsacea* Linn. var. *tridentata* Gaud.
Kamri pass.

125. *Saxifraga flagellaris* Willd.
Kalapani.

126. *Saxifraga ligulata* Wall.
Nichnai.

127. *Saxifraga odontophylla* Hk. f. & T.
Kamri.

128. *Saxifraga sibirica* Linn.
Kamri.

129. *Saxifraga stracheyi* Hook. f. & T.
Kamri.

CRASSULACEAE

130. *Sedum crassipes* Wall.
Kamri.

131. *Sedum ewersii* Ledeb.
Kamri.

132. *Sedum quadrifidum* Pall.
Vishensar.

133. *Sedum rhodiola* DC.
Kamri.

134. *Sempervivum acuminatum* Dcne.
Pushwari.

ONAGRACEAE

135. *Epilobium angustifolium* Linn.
E. latifolium Linn.
Sonamarg.

136. *Epilobium cylindricum* D. Don.
Below Kamri.

DATISCACEAE

137. *Datisca cannabina* Linn.
Badwan, Nichnai, Harn plantation.

UMBELLIFERAE

138. *Bupleurum canaliculatum.*
Gurez.

139. *Bupleurum lanceolatum* Wall.
Rattu.

140. *Bupleurum longicaule* Wall.
Kalapani.

141. *Bupleurum tenue* D. Don.
Koragbal.

142. *Bupleurum thomsoni* Clarke.
Kamri.

पुस्तकालय
गुरुकुल कांगड़ी

143. *Carum bulbocastanum* C. Koch.
Bunium persicum (Boiss.) Fd.
Koragbal.

144. *Carum carvi* Linn.
Ratu, Gurez.

145. *Angelica glauca* Edgew.
Pushwari.

146. *Archangelica himalaica* Clarke.
A. officinalis in Fl. Brit. Ind.
Koragbal.

147. *Chaerophyllum villosum* Wall.
Vishensar, Gurez.

148. *Eryngium coeruleum* Bieb.
Bandipur.

149. *Ferula narthex* Boiss.
Astore, Harchoo.

150. *Heracleum candicans* Wall.
Gurez.

151. *Heracleum thompsoni* Clarke.
Koragbal.

152. *Pleurospermum candollei* Benth.
Pushwari.

153. *Pleurospermum densiflorum* Benth.
Kamri Pass.

154. *Prangos pabularia* Lindl.
Kamri.

155. *Selinum papyraceum* Clarke.
Gudai.

156. *Selinum vaginatum* Clarke.
Pushwari.

157. *Vicatia coniifolia* DC.
Vishensar.

CAPRIFOLIACEAE

158. *Lonicera asperifolia* Hk. f. & T.
Shankergarh.

159. *Lonicera quinquelocularis* Hardw.
Shankergarh.

160. *Sambucus Wightianus* Wall.
Serrai Sonamarg.

161. *Viburnum nervosum* D. Don.
Below Tragbal.

RUBIACEAE

162. *Galium asperuloides* Edgew. (*triflorum* Michx.).
Gurez.

163. *Galium boreale* Linn.
Kalapani.

164. *Rubia cordifolia* Linn.
Sardar kothi.

DIPSACEAE

165. *Dipsacus inermis* Wall.
Kamri, Gurez.

166. *Scabiosa speciosa* Royle.
Koragbal, Kamri.

167. *Morina coulteriana* Royle.
Koragbal, Kamri, Rattu.

VALERIANIACEAE

168. *Valeriana dioica* Linn.
Kamri.

169. *Valeriana jaeschkii* Clarke.

170. *Valeriana pyrolaefolia* Decaisne.
Koragbal.

171. *Valeriana wallichii* DC.
Badwan.

COMPOSITAE

172. *Achillaea millefolium* Linn.
Koragbal.

173. *Anaphaïs nubigena* DC.
Rama.

174. *Arctium lappa* Linn.
Koragbal.

175. *Artemisia brevifolia* Wall.
Gurez, Rattu.

176. *Artemisia dracunculus* Linn.
Rampore.

177. *Artemisia grata* Wall.
Nichnai.

178. *Artemisia laciniata* Willd.
Rattu, Gurez.

179. *Artemisia parviflora* Roxb.
A. japonica Thunb.
Rampore.

180. *Artemisia siversiana* Willd.
Gurez.

181. *Artemisia vestita* Wall.
Pushwari.

182. *Aster falconeri* Butch.
Kamri.

183. *Aster flaccidus* Bunge.
A. heterochaeta Benth.
Vishensar.

184. *Aster molliusculus* Wall.
Kamri.

185. *Carduus nutans* Linn.
Kamri.

186. *Cousinea thomsoni.*
Gudai.

187. *Cremanthodium decaisnei* Clarke.
Pushwari.

188. *Doronicum Roylei* DC.
Kamri.

189. *Erigeron undryaloides* Benth.
Rampore.

190. *Erigeron multicaulis* Wall.
Tarshing.

191. *Erigeron patentisquama* J. F. Jeffrey.
Shankergarh.

192. *Erigeron multiradiatus* Benth.
Kamri.

193. *Gnaphalium stewartii* Clarke.
Rama.

194. *Inula obtusifolia* Kerner.
Tarshing.

195. *Inula racemosa* Hook.
Gurez.

196. *Inula rhizocephaloides* C. B. Clarke.
Rama.

197. *Inula royleana* DC.
Pushwari.

198. *Jurinea ceratocarpa* Benth.
Pushwari.

199. *Jurinea macrocephala* Benth.
Burzil. Raz-Dhani.

200. *Lactuca longifolia* DC.
Rattu.

201. *Lactuca lessertiana* Clarke.
Kamri.

202. *Lactuca scariola* Linn.
Rampore.

203. *Saussurea candolleana* Wall.
Kamri pass.

204. *Saussurea falconeri* Hk.f.
Sardarkothi.

205. *Saussurea lappa* Clarke.
Gurez.

206. *Scorzonera divaricata* Turcz.
Rampore.

207. *Senecio jacquemontianus* Benth.
Koragbal, Razdhani.

208. *Senecio pedunculatus* Edgew.
Tarshing.

209. *Senecio thompsoni* Clarke.
Badwan.

210. *Solidago virga-aurea* Linn.
Kamri.

211. *Tanacetum falconeri* Hk. f.
Burzil.

212. *Tanacetum longifolium* Wall.
Burzil.

213. *Taraxacum officinale* Wigg.
Kamri, Gurez.

214. *Tragopogon pratense* Linn.
Badwan.

215. *Tussilago farfara* Linn.
Astore.

ERICACEAE

216. *Pyrola rotundifolia* Linn.
Thajwas, Sonamarg.

217. *Rhododendron arboreum.*
Kamri.

218. *Rhododendron campanulatum* D. Don.
Nichnai.

CAMPANULACEAE

219. *Campanula aristata* Wall.
Kamri.

220. *Campanula cashmiriana* Royle.
Kamri.

221. *Campanula colorata* Wall. var. *tibetica* H.f. & T.
Kamri.

222. *Codonopsis ovata* Benth.
Koragbal, Charwan.

223. *Codonopsis clematidea* Schrenck.
Badwan. Charwan.

224. *Codonopsis rotundifolia* Benth.
Koragbal, Charwan.

PRIMULACEAE

225. *Androsace duthieana* R. Kunth.
Kamri.

226. *Androsace mucronifolia* Watt.
Baltal.

227. *Androsace primuloides* Duby.
Kamri.

228. *Androsace rotundifolia* Hardw.
Kamri.

229. *Androsace sempervivoides* Jacquem.
Vishensar.

230. *Cortusa matthioli* Linn.
Kamri.

231. *Primula denticulata* Sm.
Vishensar.

232. *Primula elliptica* Royle.
Kamri.

OLEACEAE

233. *Fraxinus xanthoxyloides* Wall.
Gudai.

ASCLEPIADIACEAE

234. *Cynanchum glaucum* Wall.
Shankergarh.

235. *Cynanchum jacquemontianum* Decne.
Kamri.

GENTIANACEAE

236. *Gentiana carinata* Griseb.
Vishensar.

237. *Gentiana decumbens* Linn.
G. Thianshanica Rupr.
Burzil, Gurez.

238. *Gentiana marginata* Griseb.
Kamri.

239. *Gentiana stracheyi* C. B. Clarke.
Gentiana serrata Gunner. var. *stracheyi* Clarke.
Rampore.

240. *Jaeschkea gentianoides* Kurz.
Koragbal, Badwan.

241. *Swertia perfoliata* Don.
Shankergarh.

242. *Swertia petiolata* Royle.
Pushwari.

243. *Swertia thomsoni* Clarke.
Rampore.

POLEMONIACEAE

244. *Polemonium coeruleum* Linn.
Nichnai.

BORAGINACEAE

245. *Cynoglossum micranthus* Desf.
C. lanceolatum Forsk.
Sonemarg.

246. *Cynoglossum wallichii* G. Don.
Koragbal.

247. *Echinospermum barbatum* Lehm.
Kamri.

248. *Eritrichium strictum* Dcne.
Sonamarg.

249. *Lindelofia angustifolia* A. Brand.
Kamri.

250. *Lindelofia longiflora* Baillon.
Vishensar, Nichnai.

251. *Macrotomia benthami* DC.
Vishensar.

252. *Myosotis sylvatica* Linn.
Nichnai.

253. *Onosma kashmirica* Johnnston
O. echioides.
Kamri.

SCROPHULARIACEAE

254. *Digitalis purpurea* Linn.

255. *Euphrasia officinalis* Linn.
Kalapani, Badwan.

256. *Leptorhabdos benthamiana* Walp.
Pushwari.

257. *Pedicularis bicornuta* Klotzsch.
Shankergarh.

258. *Pedicularis pyramidata* Royle.
Kalapani.

259. *Pedicularis pectinata* Wall.
Gurez.

260. *Pedicularis verticillata* Linn.
P. roylei Maxim.
Pushwari.

261. *Pedicularis siphonantha* D. Don.
Kamri.

262. *Pedicularis pycnantha* Boiss.
Rampore.

263. *Picrorhiza kurrooa* Benth.
Kamri, Gurez.

264. *Scrophularia himalensis* Royle.
S. polyantha Royle.
Koragbal.

265. *Verbascum thapsus* Linn.
Sonamarg.

266. *Veronica becabunga* Linn.
Astore, Rama.

267. *Veronica deltigera* Wall.
Kalapani.

268. *Veronica hirta* Pennell.
Kamri.

269. *Veronica serpyllifolia* Linn.
Nichnai.

OROBANCHACEAE

270. *Orobanche cernua* Loeffl.
Kamri.

271. *Orobanche orientalis* Beck.
Kamri.

LORANTHACEAE

272. *Viscum album* Linn.
Gurez.

LABIATAE

273. *Calamintha clinopodium* Benth.
Sonamarg.

274. *Dracocephalum nutans* Linn.
Sonamarg.

275. *Elsholtzia cristata* Willd.
Sonamarg.

276. *Elsholtzia densa* Benth.
Sonamarg.

277. *Lamium album* Linn.
Gurez, Haran.

278. *Mentha arvensis* Linn.
Gurez.

279. *Mentha sylvestris* Linn.
Gurez.

280. *Nepeta clarkei* Hk.f.
Koragbal.

281. *Nepeta connata* Royle.
Kalapani.

282. *Nepeta eriostachya* Benth.
Koragbal.

283. *Nepeta glutinosa* Benth.
Rampore.

284. *Nepeta govaniana* Benth.

285. *Nepeta salviaefolia* Royle.
Tarshing.

286. *Origanum vulgare* Linn.
Kamri.

287. *Phlomis bracteosa* Royle.
Nichnai.

288. *Phlomis setigera* Falc.
Koragbal.

289. *Salvia glutinosa* Linn..
Rampore.

290. *Salvia hians* Royle.
Nichnai.

291. *Salvia moorcroftiana* Wall.
Bandipore, Ganderbal.

292. *Scutellaria prostrata* Jacquem.
Kamri, Gurez.

293. *Stachys sericea* var. *alpina*.
Koragbal.

294. *Stachys sericea* Wall.
Baltal.

295. *Thymus serpyllum* Linn.
Gurez.

CHENOPODIACEAE

296. *Chenopodium album* Linn.
Astore, Bandipore.

297. *Chenopodium blitum* Hk.f.
Kamri, Charwan.

298. *Chenopodium botrys* Linn.
Rampore.

299. *Kochia prostrata* Schrad.
Rampore.

300. *Atriplex crassifolia* Camb.
Gudai.

POLYGONACEAE

301. *Polygonum affine* D. Don.
Vishensar.

302. *Polygonum alpinum* All.
Koragbal.

303. *Polygonum amplexicaule* D. Don.
Vishensar.

304. *Polygonum viviparum* Linn.
Vishensar.

305. *Polygonum dumetorum* Linn.
Budwan, Minimarg etc.

306. *Polygonum paronychioides* C. A. Mey.
Gurez.

307. *Polygonum lapathifolium.*
Pushwari.

308. *Polygonum persicaria* Linn.
Tarshing.

309. *Polygonum rumicifolium.*
Kamri.

310. *Polygonum tortuosum* D. Don.
Rampore.

311. *Rheum emodi* Wall.
Rheum Webbianum Royle.
Gurez.

312. *Rumex acetosa* Linn.
Koragbal.

ELEAEGNACEAE

313. *Hippophaë rhamnoides* Linn.
Shankergarh, Rama.

EUPHORBIACEAE

314. *Euphorbia cornigera* Boiss.
Koragbal.

315. *Euphorbia pilosa* Linn.
Shankergarh.

316. *Euphorbia wallichii* Hk. f.
Kamri.

URTICACEAE

317. *Cannabis sativa* Linn.
Ganderbal.

318. *Morus alba* Linn.
Ganderbal.

319. *Celtis australis* Linn.
Bandipore.

PLATANACEAE

320. *Platanus orientalis* Linn.
Ganderbal.

JUGLANDACEAE

321. *Juglans regia* Linn.
Gurez and Kangan.

CUPULIFERAE

322. *Betula utilis* D. Don.
Burzil, Kalapani.

323. *Corylus colurna* Linn.
Kangan.

SALICACEAE

324. *Populus alba* Linn.
Ganderbal.

325. *Populus nigra* var. *pyramidalis* Spach.
Astore.

326. *Salix alba* Linn.
Ganderbal.

327. *Salix flabellaris* Anders.
Nichnai.

328. *Salix hastata* Linn.
Kamri.

329. *Salix lindleyana* Wall. var. *latifolia* Parker.
Kamri.

330. *Salix tetrasperma* Roxb.
Nichnai.

CONIFERAE

331. *Abies webbiana* Lindl.
Gurez, Astore.

332. *Cedrus deodara* Hook. f.
Krishanaganga valley.

333. *Juniperus communis* Linn.
Rampore.

334. *Juniperus macropoda* Boiss.
Kamri.

335. *Pinus excelsa* Wall.
Sindh valley.

336. *Pinus gerardiana* Wall.
Astore.

337. *Taxus baccata* Linn.
Gurez and Astore.

ORCHIDACEAE

338. *Orchis latifolia* Linn.
Kamri, Rattu and Badwan.

IRIDACEAE

339. *Iris hookeriana* M. Fost.
Nichnai.

LILIACEAE

340. *Allium semenovii* Regel.
Kamri.

341. *Allium rubellum* M. Bieb.
Rampore.

342. *Eremurus himalaicus* Baker.
Kamri, Burzil and Gurez.

343. *Colchicum luteum* Baker.
Gurez.

JUNCACEAE

344. *Juncus himalensis* Klotzsch & Garcke.
Burzil.

345. *Juncus membranaceus* Royle.
Tarshing.

ARACEAE

346. *Arisaema wallichianum* Hook. f.
Koragbal.

NAIADACEAE

347. *Triglochin palustre* Linn.
Kamri.

GRAMINEAE

348. *Panicum miliaceum* Linn.
Astore.

FILICES

349. *Dryopteris brunoniana* C. Chr.
Vishensar.

350. *Dryopteris blanfordii* C. Chr.
Koragbal.

351. *Dryopteris filix-mas* sens. lat.
Gurez.

352. *Asplenium viride* Hudson.
Kamri.

STUDY OF THE MARINE FAUNA OF THE KARWAR COAST AND NEIGHBOURING ISLANDS

BY

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PART I: PROTOZOA TO ARTHROPODA

(With a map)

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I. INTRODUCTION

Most of the available knowledge of the fauna of the west coast of India is confined to the narrow limits of fishes, as such work was undertaken mainly by the Departments of Fisheries of the several States bordering the coast. The present work was undertaken with a view to study the fauna from an academic standpoint. Karwar being the nearest coastal town from Dharwar and exhibiting various types of ecological conditions, was chosen for study. The marine fauna of the Karwar coast has not been investigated by any zoologist so far. In 1940, however, two naturalists, Dr. Maurice Suter and Mr. Charles McCann, made certain observations which were mainly concerned with the angling of fishes and the inland fauna of the place.

With a view to collect a comprehensive knowledge of the fauna, several trips, arranged during the various seasons of the year, were carried out and these have given an idea of the seasonal fluctuations of the marine life of this coast. The animals were studied with reference to their natural surroundings, and in the present paper, no attempt has been made to study the detailed systematics of the specimens collected. Such a study has, however, been started with some groups, particularly the Mollusca, and the account will be published in due course.

The paper is written with a view to facilitate any biologist who may be interested to collect and study the forms available in this area. Hence, some of the conspicuous features of many of the animals have been included. Wherever possible the ecological conditions have also been alluded to.

I wish to express my indebtedness to Prof. P. W. Gideon, M.A., Head of the Department of Biology, Karnatak College, Dharwar, who introduced me to this interesting study by initiating and joining the collection trips and for helping me in various ways throughout the period of study. I am equally indebted to Dr. J. P. Joshua, M.A., Ph.D., Professor of Zoology, Madras Christian College, Tambaram, for his keen interest in my work and for guiding me in the field work as well as laboratory study. My thanks are also due to my colleague, Shri H. V. Kashyap, M.SC., for his helpful suggestions in preparing the manuscript. I also wish to thank my colleagues and students who joined me in the collection trips and enriched the collections.

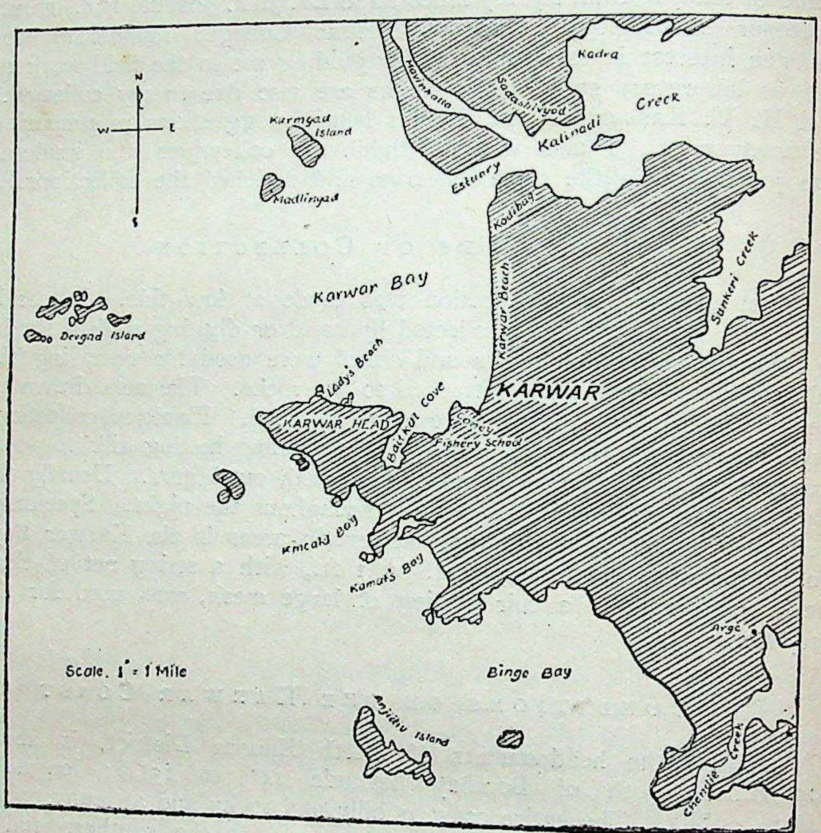
II. METHODS OF COLLECTION

Most of the shore collection was made at low tide. In sandy areas, the specimens were collected by hand or digging with a spade. In rocky areas, the hammer and chisel were used for removing the animals which were firmly attached to the rocks. The nets drawn by the fishermen to the beach were also examined. Plankton collections were made from the open sea by using a fine bolting silk tow-net, dragged along by the local boats fitted with outriggers. Usually the plankton was collected at intervals throughout the night. Specimens were also collected by dredging at certain areas in the Karwar Bay. An iron dredge measuring 2 ft. by 1 ft., with a string net of close mesh reinforced by a coir netting of large mesh, was used for the purpose.

III. CONDITIONS ON THE KARWAR COAST

Karwar, the headquarters of North Kanara District, is about 300 miles south of Bombay (latitude 14° to 15°N; longitude 74° to 75°E). The entire coast is hilly and rocky and at many points steep hills rise straight up from the sea. At the southern end a piece of land juts into the sea and is known as the Karwar Head, the shores of which are all rocky. On the northern side of Karwar Head, however, is a small sandy beach—Lady's Beach—hemmed in between two large projections of rocks. Between the Karwar Head and the mainland is an extension of the Karwar Bay, which is known as the Baitkal Cove. This cove is shallow and has a muddy bottom and nearly half of it is exposed at low tide. On the west and parallel to the town stretches the long sandy Karwar Beach, extending from the mouth of the river Kalinadi in the north to Coney Point in the south. This beach is about three miles in length and is the longest sandy beach near about Karwar.

About three miles north of Karwar town is the village, Kodibag, which is situated on the bank of the Kalinadi estuary. On the opposite bank is the small town, Sadashivgad. To the west of Sadashivgad is a small stream called Mavin Halla, which enters the Kalinadi river just before it joins the sea. At low tide a large extent of this stream is exposed forming a rich collecting ground of estuarine forms. Further up the river, on the northern bank, near the village Kadra, there is a vast muddy area which is exposed at low tide. On the southern bank, opposite the Kadra area, is a long muddy creek of the river extending for about two miles in a southern direction. This is the Sunkeri Creek. The fauna in both these areas, as also on the small mud-banks situated in the river and exposed at low tides, is very similar.


N
W
E
S
Kurmgad Island
Madlingad
Havinhalla
Sadashivgad
Kadra
Creek
Kalinadi
Estuary
Kodibag
Karwar Bay
Karwar Beach
Sunkeri Creek
Devgad Island
Lady's Beach
KARWAR HEAD
Baitkol Cove
KARWAR
Coney
Fishery School
Kincaid Bay
Kamat's Bay
Arge
Scale. 1" = 1 Mile
Binge Bay
Anjidiv Island
Chendie Creek

Karwar Coast and neighbouring Islands.

In Karwar Bay there is a cluster of islets known as Oyster Rocks. On the largest of these, Devgad Island, about seven miles west of the mainland a light-house has been built. About four miles north-east of these rocks are situated two more islets known as Madlingad and Kurmugad. Five miles south-west of Karwar and about two miles from the mainland there is a Portuguese island known as Anjidiv.

Along the road to Ankola, the rocky coast is broken up by several sandy beaches which are placed in between groups of rocks that jut into the sea. The first of these sandy beaches is called Kincaid's Bay and is about a mile from the town. Further down about two miles and three miles from the town, are Kamat's Bay and Binge Bay respectively. The majority of the animals recorded in this paper have been collected from Kamat's Bay. About five miles from Karwar, on the road to Ankola, is the village Arge.

Between this village and the sea, there is an expansive flat sandy area (about 6 sq. miles), through the middle of which a narrow stream meanders into the sea. This area called the Chendie Creek is completely submerged at high tide.

Thus Karwar presents a variety of ecological conditions showing a representative marine fauna. There are sandy beaches, rocky shores, islands, coves, creeks, an estuary, mud-flats and marshes, all within easy reach of the town.

IV. SYSTEMATICS

PROTOZOA

All the Protozoans recorded were from the plankton collected in Karwar Bay. The majority of the forms are flagellates belonging to the genera: *Noctiluca, Ceratium, Gymnodinium* and *Peridinium*. *Noctiluca* has been observed in large numbers and they can easily be recognised at night by the bio-luminiscence they exhibit whenever the surface water is disturbed. *Ceratium* is represented by three species: *C. tripos, C. fusus,* and *C. furca.*

Radiolarians were represented by the genus, *Acanthometra,* which were seen in quite good numbers, especially in the plankton collected at midnight. Sometimes, a few living Foraminifera have also been observed in the plankton. Large numbers of their skeletons, however, are washed ashore and can be seen if a sample of sand is examined under the microscope. The Ciliates are represented only by the Vorticellids attached to bits of sea-weeds.

PORIFERA

No special search for sponges has been made, but a few pieces washed ashore and some encrusting on the rocks have been collected. *Adocia* is the encrusting form found on the rocks of Kamat's Bay and Binge Bay. It may be orange, yellow, green or blue in colour. *Halisarca* is the one that is usually washed ashore and has been collected at Kamat's Bay and Anjidiv island. It consists of small branches with conspicuous oscula.

COELENTERATA

Coelenterates are well represented in Karwar. They include the representatives of all the four classes of the phylum except the corals, which have not been observed in a living condition at all, but a few pieces of dead coral have been collected occasionally on the shore. The most familiar coelenterate, however, is the jelly-fish.

HYDROZOA:

Sertularia is the most common form found beneath the rocks on all the rocky shores. The colonies are dark in colour and may be found under water or sometimes exposed at low tide. A few hydrozoan medusae and some microscopic siphonophores have been observed in the plankton. *Physalia*, one of the large siphonophores, has often been found washed ashore, and *Porpita* is frequently seen floating about as a disc with dark blue-green marginal tentacles. Two other siphonophores, *Diphyes* and *Monophyes*, have been collected in very large numbers, only once, during May 1946, in Kamat's Bay. The whole beach was glistening with the beautiful floats of these forms.

SCYPHOZOA:

Two common jelly-fishes known in Karwar are *Dactylometra* and *Acromitus*. *Dactylometra* is the larger of the two types, where the umbrella is comparatively flat and the surface coarse to the touch. The lips are produced into long delicate arms. *Acromitus* has a dome-shaped umbrella with a smooth outer surface which appears finely granular when magnified. The lips are divided into eight short thick arms, each produced into a long thread-like filament. In certain seasons, generally during the cold weather, these jelly-fishes appear in shoals and are found washed ashore in enormous numbers.

ANTHOZOA:

Among the Anthozoa, sea-anemones and *Cavernularia* are the only forms best represented in Karwar. Corals are almost absent and none have been recorded in the living condition so far, but dead and worn out pieces of the coral, *Goniastraea*, have been collected sometimes. Fragments of *Gorgonia* have also been collected occasionally on the shore. Sea-anemones have been recorded in a variety of places, on free surface of rocks, in the holes and crevices of rocks, buried in sand, in rock-pools and attached to molluscan shells either empty or occupied by hermit-crabs. The sea-anemones occurring in these habitats are described as follows:

Actinidae: *Anemonia* is fairly common in the intertidal zone, generally on bare surfaces or crevices of rocks. The margin of the discs bears a number of irregularly arranged knobs and numerous tentacles. The animals are usually red in colour, sometimes purple, and the tentacles are darker or even deep violet with light-coloured tips.

Bunodactis has a number of species very variable in its characters, but all have longitudinal lines of warts on the column. The species found in Karwar are about 1½ inches in length and are attached to rocks either submerged in water or exposed only at low tide. The upper part of the column bears longitudinal rows of suckers to which are attached fragments of shells and other particles. The disc is greenish in colour and the tentacles are pale and pointed.

Sagartidae: *Sagartia* is a very common form attached to molluscan shells, empty or occupied by hermit-crabs. Many have been collected attached to empty shells of *Turritella* (*T. acutangula*) buried in the sand with only the disc exposed. When contracted, *Sagartia* looks like a small translucent onion with a few filaments projecting from the pointed end. These anemones are brownish yellow in colour with light longitudinal stripes. When fully expanded the column is about two inches in length.

Zoanthidae: *Zoanthus* is a small colonial form frequently seen in the crevices of rocks or in the rock-pools in the tidal region. Its column is long and yellowish grey in colour and the disc presents shades of brown with a variety of green marks. The tentacles are striped and are of different colours. When sand particles are strewn over the disc by the action of waves, the animal is difficult to detect.

Gemmaria is similar to *Zoanthus*, but is smaller and generally found in large numbers spreading over the rocks. When expanded, they form a conspicuous mosaic of hexagonal figures. They usually grow on horizontal and vertical surfaces of rocks. These animals are sand-encrusted and leathery to the touch. The column and the tentacles are brown and the disc is green.

Cavernularidae: *Cavernularia* is a pear-shaped colonial form and a very beautiful object to see when expanded. They stand erect in water with only the stalks buried in the sand. They have been observed in large numbers in their natural surroundings, in the creek at the mouth of the river Kalinadi. Occasionally, however, they are washed on the beach in a contracted condition, when they look like short clubs with narrow grooved handles and with brown depressions over the rest of the body, indicating the position of the contracted polyps.

CTENOPHORA :

Two representatives of Ctenophora, observed in Karwar, are *Pleurobrachia* and *Beroe*. *Pleurobrachia* has been collected in large numbers, washed ashore on the beaches and looking like small blobs of jelly. *Beroe* has also been collected occasionally on the shore and sometimes in the plankton.

PLATYHELMINTHES

The common marine flat-worms are the planarians, found crawling on the rocks, sea-weeds and among the bivalve molluscs. Some have colours merging with the background, sometimes brown and grey, and are often inconspicuous, while others are brilliantly coloured. The planarians of Karwar have not been identified.

NEMERTEA

The Nemertine worms, collected from Kamat's Bay, were found on the rocks among the attached animals and sea-weeds. Only two forms are known. *Eupolia* is a slender brownish red worm with a dark streak on the middle of the back. It was about ten inches in length when expanded. Another worm about twenty inches long was collected from the same locality. It was violet in colour with regular, narrow, circular white bands at intervals. It resembled *Tubulanus* (*Carinella*, McIntosh), recorded in the British Isles,

ANNELIDA

The free-living Polychaets are represented by a number of Nereid worms collected from sea-weeds, among encrusting animals on rocks, and various other habitats. *Polynoe* is commonly found on the underside of the rocks on all rocky shores. Post-larval Polychaets have also been collected from the plankton. The tubicolous Polychaets are represented by the following four forms :

Polycirrus and *Terebella* are recognised by their numerous long, orange-red, brightly coloured, sticky tentacles. They have been collected from the empty oyster shells encrusted on the loose rocks in the muddy areas of Kadra and Chendie Creek.

Owenia is found in large numbers in Kamat's Bay. They live in sandy tubes which are so closely packed together, that they give the appearance of coral-like encrustations, extending over a large area in the inter-tidal zone. The mouth of the worm is surrounded by a membrane which has marginal filaments.

Spirorbis lives in small calcareous tubes found as encrustations on the sea-weeds. They occur in large numbers all over the coast.

Sternaspis is a representative of the burrowing Polychaets and has been collected by dredging in Karwar Bay. It possesses a short body with a thickened anterior region, carrying on each side three rows of setae. On the ventral side of the posterior end of the body, there is a bilobed horny plate with a number of bundles of long setae. The anus is situated on the dorsal side with two bundles of filamentous branchiae on either side of it.

Dendrostoma is the only Sipunculid represented and is found burrowing into the sponges encrusting the rocks. It is shaped like a base-ball bat, the handle being the neck which is protrusible through a circlet of branching tentacles. Usually it is about four inches in length.

ARTHROPODA

CRUSTACEA :

The Crustaceans, which form the bulk of the marine Arthropods, are found almost everywhere in Karwar. It is difficult to avoid seeing or coming across a crab in any locality of Karwar. Large numbers of Dhobi-crabs waving their coloured chelae can be seen in a number of places. Hermit-crabs inside empty molluscan shells are found everywhere near the shore. The plankton teems with a large variety of minute crustaceans and their larvae. The following are some of the common crustaceans recorded :

COPEPODA : A large number of Copepods are found in the surface waters and have been collected in the plankton. *Calanus* is the most common and is cosmopolitan in distribution. It is recognised by its iridescent plumed hairs borne on different parts of the body, the long antennae and the single egg-sac. There are also many forms of copepods parasitic on the body of fishes.

CIRRIPEDIA: Acorn-barnacles are by far the commonest. They are found in vast numbers attached to rocks, to wood and to molluscan shells. The following two species are met with in large numbers:

Balanus tintinabulum (Linnaeus) is a large barnacle with purple coloured plates and is found on rocks which are always very near the water.

Balanus amphitrite (Darwin) is a small and lighter coloured animal, found in thousands encrusting the rocks in or near the water. They are found so crowded together that they almost look like sheets covering the rocks.

A point to be noted regarding the feeding habits of these barnacles is that they are dependent on the place of their attachment. Thus, those that are permanently submerged can feed at all times; those living between tide marks obtain their food only twice a day during high tides; and lastly those that live beyond the high tide level get only what little food is provided by the spray that comes their way.

Goose-barnacles are not very common in Karwar. Only two forms have been collected.

Lepas, attached to floating pieces of wood and cuttle-bones, has been occasionally found washed ashore.

Ibla quadrivalvis (?) is found in small groups attached to stones in Kamat's Bay. It is easily distinguished in having only two terga and two scuta, and the animal is completely covered by soft brown spines pointed posteriorly. This species is interesting in that, though its presence in the Indian Ocean has been recorded, the exact locality where it occurs seems not to have been known so far.

Sacculina is the parasitic cirripedia observed on the crab (*Neptunus*), which have been collected from the rampan nets.

ISOPODA: As elsewhere, the Isopods are quite abundant in practically all littoral regions of Karwar. The majority of them are small and many are coloured like their surroundings. Those found among the sea-weeds have almost the same colour as the sea-weeds, red, green or brown. Those living among the rocks are slate-coloured, e.g. *Ligia*. *Ligia exotica* (Roux) is found in large numbers on boats, on logs of wood near water, and along the rocks and stones of the shore. They are semi-terrestrial, living near the water, and would be drowned if submerged for sometime.

Cymothoa has been observed living parasitically in the mouth of Pomfrets (*Stromateus*). It is possible that more isopod parasites would come to light if further search is made, in view of the fact that Karwar has such a rich variety of fishes.

AMPHIPODA: Amphipods are also quite abundant in the littoral regions. *Stenothoe* is a very common sand-hopper, living on sand or on decaying sea-weeds, easily recognised by its jumping movements. Another odd-looking amphipod, seen crawling over the hydroids or algae, is a Caprellid. They move about like a caterpillar with looping movements and their colouration is similar to that of the surroundings.

STOMATOPODA: *Squilla* is the only Stomatopod collected at Karwar. They are seldom found with the objects washed up on the shore, but are brought in by fishermen in their nets and are discarded as they are inedible. They need to be handled with care because they can inflict injuries with their tails and maxillepedes. *Alima*, the larva of *Squilla*, has often been observed in the plankton. It is recognised by its great size (about 3 cms. in length), glass-like transparent body, long, broad carapace, unlike that of the adult, and and a pair of prominent stalked eyes.

DECAPODA: The first large living animals that one frequently meets on the shores of Karwar, are the Decapods, be it a prawn, swimming in the shore waters, or a crab, running about on the beach, or a hermit-crab, strutting about with a molluscan shell.

MACRURA:

Penaeus is the common edible prawn that is sold in the market, either in fresh condition or dried. They can be recognised by their serrated rostrum and chelate legs. They are usually brought to the shore by the fishermen in their nets.

Lucifer, with its elongated body, slender limbs and long eye-stalks, is a luminiscent form usually found in the plankton.

Alphaeus is found in the crevices of rocks. Its first thoracic leg, either the right or the left (never both), is very much enlarged. They make a peculiar noise by means of these appendages.

Hippolysmata, possessing a large rostrum and prominent eyes, is usually found in rock-pools and on sea-weeds.

Panulirus is the 'painted spiny lobster' living on the rocks, whose skeleton is often washed ashore.

ANOMURA:

Hermit-crabs, living in empty molluscan shells, are found in large numbers on the shores and also in the rock-pools. A majority of the Karwar forms belong to two genera: *Diogenes* and *Pagurus*, which are recognised by their unequal chelae. Those living in water often carry sessile animals like *Sertularia*, *Sagartia*, or *Balanus amphitrite*, on their backs.

Porcellana is usually found living under encrusting sponges, ascidians and hydroids. Their abdomen is symmetrical and flexed beneath the thorax and bears a well-developed telson. In the plankton, the peculiar Zoea larva of *Porcellana* is observed quite frequently and is readily recognised by the enormously long rostrum and posterior spines.

Emerita asiatica (Milne-Edwards), the mole-crab has an oval body about one inch in diameter and is pinkish in colour. They are very abundant occurring on open sandy beaches between tide marks. As the waves beat shoreward, they emerge from the sand and are carried higher up the shore along with the water, thus exposed to view for a brief period, and when the waves recede they rapidly burrow into the sand and wait for the next wave to repeat the process. During low tide, when they are stranded on the shore, they burrow deep into the sand and reappear at the next high tide.

Albunea symnista (Linnaeus) is another mole-crab, stouter than *Emerita*, and lives buried in the sand below the low tide level, but is sometimes brought to the shore entangled in fishermen's nets. Very few of them have been collected.

BRACHYURA:

Crabs form a characteristic group of the fauna of Karwar. They are found in very large numbers, in a variety of habitats all along the coast. Only those actually found on the shore, or those living in areas adjoining the shore, have been described here. Other crabs living beyond the littoral zone are known only by their remains that are washed ashore from time to time. Crabs belonging to the following six families have been recorded.

Calappidae:

Calappa lophos (Herbst) and *Matuta victor* (Fabricius) are represented here, and of these the former is rare and the latter more numerous.

Calappa lophos has a large arched, semicircular box-like carapace and the crested chelae are massive and fringed with hairs.

Matuta victor has a rounded carapace with a single stout triangular spine projecting on each side. The two chelate arms are large and the four pairs of legs are broad and flat and are used as paddles when swimming. It is much more active than *Calappa*, but usually spends much of its time buried in sand between the tide marks.

Leucosiidae:

Philyra scabriuscula (Fabricius) is the most common species and is found in large numbers on the sandy beaches between tide marks in Kamat's and Binge Bays. They are small lightly coloured crabs, more or less globular in shape, with long slender legs. They are usually seen hurriedly burying themselves into sand as the waves retreat.

Portunidae:

These are swimming crabs with only the last pair of legs paddle-like, the first three pairs being adapted for walking. The carapace is depressed with distinct characteristic teeth on the antero-lateral margins. The following three are the most common genera: *Neptunus, Charybdis* and *Thalamita*. These are the common edible crabs sold in the market and are collected from fishermen's nets.

Neptunus is recognised by the antero-lateral margin of the carapace bearing nine teeth and a long spine projecting sidewards. Two species have been collected: *Neptunus pelagicus* (Linnaeus) and *N. sanguinolentus* (Herbst). In the former, the carapace has a network of coloured markings and the back margin of each of the chelae bears a terminal spine. It is commonly seen swimming rapidly in the shallow waters of the creeks, with one chela stretched and trailing behind, and then often mistaken for a fish. In *N. sanguinolentus*, the carapace is uniformly coloured with three large red spots on it, and the back margin of the chelae is without teeth.

Charybdis has the antero-lateral margin of the carapace with six teeth and is collected in good numbers from the nets. In one species, *C. crucnera,* the design on the carapace looks like two angels on either side of a distinct cross and it is therefore held in reverence by some Christians.

Thalamita has five teeth along the antero-lateral border and the eyes are widely separated. It is usually found in the creeks.

Xanthidae:

Xantho and *Atergatis* are the two forms found on rocky shores between tide marks. The antero-lateral borders of the carapace are thick and blunt. *Xantho* is small with heavy chelae and the surface of its carapace is furrowed. *Atergatis* is bigger and oval in shape, with the surface of the carapace smooth and pink coloured with small white spots all over.

Grapsidae:

Grapsus strigosus (Herbst) is the common form found in large numbers on the rocky shores, seen either in or out of water. They are very active crabs with a medium sized, roughly hexagonal, flattened carapace, which is green in colour and shows dark stripes directed towards the posterior median line.

Ocypodidae:

The members of this family are very prolific on the shores and the creeks. The carapace is more or less convex, eye-stalks greatly developed, and the legs have pointed ends. They are active creatures living in deep burrows on the sandy shores. This family is represented by the following three genera: *Ocypoda, Dotilla* and *Gelasimus.*

Ocypoda is a familiar genus living in burrows in the sand near or above the high tide mark. They are flesh coloured, with the eye-stalks extending beyond the corneal surface. They run fast on the tips of their legs, keeping the body well raised above the ground. When chased they retreat into their burrows or escape into the sea. They can be seen in large numbers at night.

Dotilla are found moving about in groups of thousands in the Chendie Creek. They are small in size with globose bodies, living in sand or mud only below the high tide level, usually in the backwaters, but never on steep beaches. Their appendages are slender and pink coloured, and the body is dark.

Gelasimus or the 'dhobi-crab' is more common than *Dotilla* and is found in very large numbers on sand or mud banks of Chendie Creek and Kalindi estuary, usually along with *Dotilla.* The males are characterised by having one chela very large and brilliantly coloured, and they have a peculiar habit of constantly waving this chela (like a dhobi beating clothes on a stone, hence the name), sitting at the mouth of its hole, presumably to attract the mate. Extensive areas of mud banks with thousands of waving chelae of these crabs is a very impressive sight in Karwar.

ARACHNIDA:

The only marine arachnid observed is a pycnogonid occurring in Kamat's Bay. These 'no-body-crabs' are generally found crawling among the hydroids, sea-weeds and polyzoans.

INSECTA:

Strangely enough there is only one true marine insect, which is found in the sea far from the shore. It is the wingless bug, *Halobates*, whose eggs in various stages of development are often found on the cuttle-bones washed ashore.

Cicendela is a beetle, that is found on the shore among decaying weeds, and is recognised by the way it takes to wing when a wave rushes up, and settles on the sand as soon as the water recedes. *Dermestes vulpinus* is another beetle found in large numbers infesting the fish that is being cured.

A species of *Musca* is found in thousands in the fish-curing yards during the mackerel season. There is also a species of *Tabanus*, a few specimens of which have been collected in Kamat's Bay.

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ON AN INTERESTING CASE OF CARP SPAWNING IN THE RIVER CAUVERY AT BHAVANI DURING JUNE, 1947*

BY

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INTRODUCTION

The fluviatile species of Indian carps generally breed during the monsoons, June to August and November to December. Hora (1945) reviewing our knowledge of the breeding conditions of Indian carps concludes that 'a heavy monsoon flood is the primary factor that influences the spawning of Indian carps and that the other topographical, chemical and physical changes in the environment of the fish are entirely dependent on it'. He further states that there is 'a consensus of opinion that the flooded condition of a river or a tank is the primary factor that is responsible for the spawning of Indian carps'. Mookerjee (1945), on the other hand, considers dissolved oxygen as a factor of primary importance in inducing spawning of fish. According to him 'practically no freshwater fish spawns without some amount of rain water mixed with the old water of the pond', and 'for major carps almost pure rain water is needed' for spawning. But in a previous contribution Ganapati and Alikunhi (1950) have endeavoured to show that spawning mainly depended on the availability of suitable shallow spawning grounds and have pointed out how Hamid Khan's observations (1947) also support the same view, although the latter arrives at a different conclusion. In the present paper a peculiar instance of carp spawning in the river Cauvery at Bhavani in South India, is described which further supports the view that while neither rain water nor turbid flood water is essential for spawning, the availability of suitable spawning grounds appears to be the deciding factor to induce spawning.

PRE-SPAWNING CONDITIONS

The south-west monsoon was practically a failure in Madras during 1947 and water level in the Stanley Reservoir, Mettur Dam, was therefore very low. There was no rain in the Mettur-Bhavani area during June. The water in the reservoir was very clear and not muddy-brown, since rains were scanty in the upper reaches also. The level of water in the reservoir was maintained at the surplus level only from the 1st to the 20th June, when the surplus channel ceased to function. The level of water in the river below the dam, consequently, was very low resulting in portions of the river-bed being exposed and dry. When the surplus channel was not functioning, limited quantities of water were

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being sent out through the sluices, for irrigation purposes and this, besides maintaining a continuous flow of water in the stretches of the river Cauvery immediately below the dam, had resulted in the re-inundation of the shallow portions of the river-bed which had previously become exposed when the surplus channel ceased to function. Owing to the failure of monsoon rains, almost summer conditions thus prevailed in the river and the water was very clear with a bluish tinge.

SPAWNING IN THE RIVER

From 23rd June 1947 onwards the River Survey Staff at Bhavani were obtaining a few eggs, almost daily, in the spawn nets fixed in the river proper, at Bhavani. The time of collection varied from 6 p.m. to 8 a.m., but the eggs were collected usually in the morning for a few hours only. These contained mostly catfish eggs; and the local staff had not made any systematic attempt to ascertain when the eggs began to appear in the nets daily and whether carp eggs were also available in the river at any other time of the day.

Detailed observations were carried out on 28th and 29th June 1947. Samples of water were collected for analysis at four-hourly intervals and by 6 p.m. spawn nets were fixed at a selected spot about a furlong below the bridge and close to Kumaramangalam on the left bank of the river near the marginal zone where the depth of water was only about 2·0 to 2·5 feet, and where there was fairly rapid flow of water from the main current. The nets were examined at hourly intervals but till 11 p.m. no spawn was collected in them. From 12 p.m. (mid-night) onwards carp eggs began to be caught in the nets in large numbers. The physico-chemical conditions of water prior to and during collection of spawn were as shown on page 142.

The water was flowing at a velocity of about 5 miles per hour. Phytoplankton was fairly rich and representative, and consisted of Myxophyceae (*Merismopedium*, *Microcystis*, *Oscillatoria*, *Anabaena* and *Anabaenopsis*), Chlorophyceae (*Scenedesumus* and *Mougeotia*), Bacillariae (*Synedra* and *Navicula*), Dinophyceae (*Peridinium* and *Glenodinium*), and Euglenophyceae (*Euglena*). Zooplankton was poor and consisted of stray specimens of copepods (*Cyclops* and *Diaptomus*) only.

During the period of about 22 hours there had been no appreciable change in the physico-chemical variables of the river water. While neither the actual spawning ground nor the process of spawning was observed, the fact that there was no appreciable change in the physico-chemical conditions immediately prior to and immediately after spawning probably shows, that the spawning conditions were not widely different.

NATURE OF THE SPAWN COLLECTED

The mid-night collection contained fertilized, developing eggs, in advanced stages of segmentation. All the eggs were more or less in the same stage of development—the blastoderm cells about to commence invasion of the yolk. The eggs were almost transparent, with spacious perivitelline area. The diameter ranged from 2.8 mm. to 4.0 mm. There were no catfish eggs. Three distinct sizes could be distinguished in this collection of eggs. These were isolated and kept for rearing

TABLE I

Physico-chemical conditions of water in the River Cauvery, at Bhavani on 28th and 29th June 1947, when carp spawn was collected.

Date	Pre-spawning 28-6-'47				During (?) and immediately after spawning 29-6-'47								Remarks
	6 p.m.		10 p.m.		12 Midnight		4 a.m.		6 a.m.		10 a m.		
	Sur.	Bot.	Sur.	Bot.	Sur.	Bot.	Sur.	Bot.	Sur.	Bot.	Sur.	Bot.	
Meteorology ...	No moonlight—No rains				Moon-light — No rains								
Colour ...	Bluish-green				← Bluish-green →								
Turbidity ...	>30 cms.				← >30 cms. →								
Depth at collection spot. ...	2·0—2·5 ft.				← 2·0—2·5 →								
Temp. (°C) ...	29·4	29·3	29·3	29·3	28·8	28·8	28·3	28·3	28·2	28·2	28·8	28·7	
Free CO_2 ...	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	
CO_3* ...	0·3	0·3	0·3	0·3	0·3	0·3	0·3	0·3	0·3	0·3	0·3	0·3	
HCO_3* ...	18·147	18·300	17·995	17·995	17·995	17·690	17·690	17·995	18·300	18·300	17·690	17·690	
pH. ...	8·7	8·6	8·6	8·6	8·5	8·5	8·5	8·5	8·5	8·5	8·5	8·5	
D.O. (cc./L.) ...	5·165	5·305	4·886	4·886	4·746	4·746	4·746	4·746	4·886	4·886	5·016	4·956	
% Sat. ...	92·9	94·2	86·7	86·7	83·6	83·6	82·9	82·9	85·2	85·2	88·3	88·3	
Chlorides* ...	1·7	1·7	1·7	1·7	1·7	1·7	1·7	1·7	1·7	1·7	1·7	1·7	
P_2O_5 ...	+	+	+	+	+	+	+	+	+	+	+	+	
NO_3N ...	+	+	+	+	+	+	+	+	+	+	+	+	

*Results expressed in parts per 100,000.

for purposes of identification. The nets were thereafter cleared at hourly intervals. Collections continued to be heavy, but eggs in advanced stages of cleavage were not available. Embryonic development had progressed in the meantime and as the day advanced only eggs with well differentiated embryos, executing movement inside, could be procured. These later collections contained about 10% of catfish eggs which were easily distinguished by their greater opacity and the conspicuous zona radiata forming a thick membrane outside the vitelline membrane. By about 8 a.m. carp eggs were not available in the river and the net collections contained only few catfish eggs with fairly advanced embryos.

The collections were repeated on 30-6-47 (night) also, but were not as heavy as on the previous night.

The different types of eggs were carefully described and reared in the laboratory. Samples were transported to Madras and after successful rearing for about three weeks, were identified. The largest eggs, about 4.0 mm. in diameter, were those of *Labeo fimbriatus* (15%), the medium sized eggs (about 3.4 mm. in diameter) were those of *Cirrhina reba* (60%) and the third type, the smallest (diameter, 2.8 mm. to 3.0 mm.) were those of *Garra mullya* (25%). Details of the embryonic and larval development of these species are described by Alikunhi and Rao (1951). The catfish eggs could not be reared to the stage at which they could be identified for species.

DISCUSSION

Upto 3-6-1947 carps had been spawning in the Cauvery, every day, continuously for over a week. On 29-6-'47 when a thorough study was made and collections were taken during the night, large number of eggs could be obtained. Spawning on the 30th also was fairly heavy. While, on the previous days, no attempt was made to collect spawn either during the night or in the early morning hours, the collection of only limited number of catfish eggs after 6 a.m. does not preclude the possibility that spawning might have been more or less heavy during these days also. In all probability spawning was perhaps continuing after the 30th June also. Extended spawning has thus been taking place in the river and all these days almost summer conditions were prevailing in the locality and all along the river. No sudden fluctuations in the physico-chemical conditions of water were recorded during this period. Monsoon floods and turbid flood water that are generally associated with carp spawning were *absent* in the present instance where the river water was perfectly clear and had a bluish-green colour. As there were no rains during this period and as only stored and settled water was being discharged from the Stanley Reservoir, at Mettur Dam the river water had no admixture of fresh rain water either. In spite of these, the conditions were congenial for *L. fimbriatus*, *C. reba* and *G. mullya* for continued spawning. It is thus an instance which seeks exception to the statements that a heavy monsoon flood is the primary factor that influences spawning of Indian carps (Hora, loc. cit.) and that practically no freshwater fish spawns without the influence of some amount of rain water (Mookerjee, loc. cit.). The observations of Hamid Khan (loc. cit.) also support the above conclusion, although his own inference is that sexual play of the breeders induces spawning.

In the Batala fish farm in the Punjab he found that so long as the breeders remained confined in the tank, they did not spawn even when flood water entered the tank, but when they were given access to inundated fields they spawned. It is therefore obvious that availability of and access to shallow spawning grounds was the deciding factor that induced the fish to spawn. While the instance of spawning recorded in the present paper took place under extraordinary circumstances, it clearly shows that even when the monsoon fails, if spawning grounds are available the fish readily spawns.

While large numbers of eggs were collected, the actual spawning grounds could not be located and the process of spawning was not observed. The exact conditions of the water at the spawning ground at the time of spawning are therefore not known. However, as already indicated, the facts that the physico-chemical conditions of water in the river for over a week were more or less uniform and that the pre- and post-spawning conditions do not show any significant difference probably justify the assumption that the spawning conditions were perhaps the same as those soon after spawning, when the first collection of eggs was detected in the nets. A critical study of the physico-chemical conditions attending spawning (vide Table I) shows that factors like turbidity, flow of water, pH., dissolved oxygen, percentage of saturation of dissolved oxygen, free carbon-dioxide, etc. had not appreciably changed at the time of spawning. The dissolved oxygen and percentage of saturation during day time (10 a.m.) as also in the evening (6 p.m.) when no eggs were available, were higher than the same at 10 p.m. to 12 midnight when eggs began to appear in the nets. The view that high dissolved oxygen content which is associated with rain water is the deciding factor for inducing spawning cannot, therefore, be supported from the present observations. While the temperature of water during the day did not show any marked fluctuations, it was found that during the time of spawning (when the first lot of eggs were collected) there was a slight reduction in temperature, accompanied by homothermal conditions from top to bottom. The eggs collected at 12 midnight being 3 to 4 hours old after fertilization, the spawning time is indicated as 8 to 9 p.m. The temperature of water in the river at that time was about 0.5°C higher than that at 12 midnight. Homothermal conditions probably prevailed from 9 p.m. onwards. Other than this factor there is nothing to explain why the fish were spawning only in the night.[1] The almost routine manner in which spawning had been taking place in the river for over a week also probably indicates that no particular factor other than the diurnal fluctuations in temperature was immediately responsible for inducing them to spawn during the night. These fluctuations are, however, very slight and since major carps are known to spawn at all times of the day, some other explanation has to be sought for this continued spawning during nights only. Of course, the re-inundation of shallow portions of the river-bed by water discharged from the sluices in the Mettur Dam had provided ample suitable spawning grounds in the river itself. When the surplus channel of the dam is functioning, the water level in the river will be high and naturally there will be considerable depth of water over the above mentioned shallow portions of the river bed. But as already explained, when the surplus ceased to function there was a sudden lowering of the level which exposed the shallow portions. The discharge of water from the sluices started on the 21st June and the collection of eggs from the 23rd June onwards indicates that the fish had responded quickly to the re-inundation of the shallow spawning grounds. It would thus be apparent that the availability of and access to suitable spawning grounds with shallow depth of water at the right time of maturity of the fish is the most important single factor that induces spawning of carps.

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[1] Can perhaps light intensity have any effect on actual spawning ?—Eds.

The eggs that were first caught in the nets at midnight on 28-6-'47 were only about 3 to 4 hours old after fertilisation. Assuming that as soon as laid these eggs were drifting with the current which was flowing at the rate of about 5 miles per hour, the spawning would have occurred in the river about 15 to 20 miles above the collection spot. Later collections procured only eggs in advanced stages of differentiation and according to the above assumption the eggs collected at 6 a.m. at Bhavani, being about 9 to 10 hours old after fertilization, should have been liberated at about 45 to 50 miles above the collection spot. This however, appears to be highly improbable since spawning in all probability had taken place at one or more points below the Mettur Dam only, which is about 27 miles above Bhavani.

It is therefore possible that fish began to spawn, more or less at the same time, in scattered spawning grounds within the 27 miles stretch of the river between Mettur Dam and Bhavani. Spawning might have taken place in relatively sheltered places where the current was not fast. The eggs would take a longer time to drift into the main current from such places than when they are laid in the main current itself; and hence the nearest spawning ground from the collection spot might well have been within a couple of miles distance. The eggs from the nearest spawning grounds to the collection spot got drifted and were caught first, while those from farther grounds took a longer time to be drifted into the nets and were thus in advanced stages of differentiation.

SUMMARY

1. A peculiar instance of carp spawning in the river Cauvery, within the Mettur-Bhavani stretch under almost summer conditions, is described.

2. Monsoon floods and turbid flood water generally associated with carp spawning were absent and the water was clear and bluish-green in colour.

3. The dissolved oxygen content and the percentage of saturation of dissolved oxygen in water were not higher at the time of spawning than at other times of the day.

4. Other physico-chemical factors like flow of water, pH, free carbon dioxide, carbonates, bicarbonates, etc., did not show any significant variation during pre-spawning, spawning and post-spawning periods.

5. Availability of and access to suitable shallow spawning grounds with shallow depth of water, even in the river bed itself, at the right stage of ripeness of gonads appear to be the most important factors inducing spawning.

6. Fish appear to spawn more or less at the same time, in a fairly long stretch of the river, in areas where the current is slow and from where the eggs slowly get drifted into the main current.

7. The spawn collected was reared in the laboratory and was identified as that of *Labeo fimbriatus*, a major carp of the Cauvery, *Cirrhina reba*, a minor carp extensively used for stocking purposes and *Garra mullya*. Catfish eggs collected could not be reared.

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BIRDS AND ECOLOGY

BY

M. D. LISTER

1. WHAT IS ECOLOGY?

Ecology is the study of plants and animals (in the widest sense) in relation to their surroundings. It is in the meaning to be given to the term 'surroundings' that the real extent of the subject lies. One is inclined to think of surroundings as 'just a bit of jungle', as though it were quite fixed and subject to no change; but we must think of them instead as consisting of the earth on which the jungle grows and the rocks under the earth, as well as the atmosphere whose warmness or coldness and humidity influence the type of plants growing in the jungle, if we are to understand the relationship at all. This larger conception of the surroundings is referred to as a 'habitat', and the study of the habitat is the foundation of all ecological work. The ocean is just as much a habitat for the whale, and the body of the host is just as much a habitat for the parasite, as the jungle is for a tiger or a bird.

Having determined and described the habitat, the next logical step is to catalogue exhaustively the plants and animals and other livestock to be found there. In a full ecological survey this is done by the collection of specimens, and this is the only satisfactory way in which the identity of many species can be established beyond doubt. It is, however, still possible to do useful work without the collection of specimens. The fauna and flora having been adequately catalogued the way is open for the more interesting and complex aspects of the full survey—the study of the inter-relationship of animals and plants among themselves, the effects of changes in their environment brought about by such matters as changes in the food supply, by drought, flood and disease, and so on. There are many more factors which need not be mentioned here, for there will be few amateurs who are able or qualified to carry out work of such detail and complexity in such a way as to satisfy the scientists; for true ecology is rapidly becoming a science. To investigate fully the structure of a community and the effects on that community of the many variable factors which may play upon it, needs advanced scientific training, a good deal of equipment, the co-operation of other experts, and an abundance of time and patience.

In view of the difficulties which attend a full ecological survey of any natural community, it is not surprising that a good deal of attention has been given, particularly in Europe and America, to more limited aspects of ecology. Many enquiries have now been undertaken either into one particular subject such as the habits and habitats of Antarctic whales, or the fisheries of the North Sea, or to answer some particular question such as the enquiry undertaken in the British Isles during the recent war to find out just what damage was done to crops by Wood Pigeons (*Columba palumbus*). On the medical side there are the well-known investigations of Ross into the activities and life-history of the malaria-carrying *Anopheles* mosquito, and similar investigations on the fleas carrying bubonic plague. Properly controlled enquiries into selected subjects are of the utmost importance to mankind.

It is not quite so easy to see just how investigations into the ways and habits of birds can benefit man in any material sense, but it must be remembered that this is as yet almost a virgin field which on close study may well reveal causes and effects hitherto quite unsuspected. A few years ago it was thought that the Starling (*Sturnus vulgaris*) was responsible for carrying foot and mouth disease to Great Britain from the Continent of Europe, though the general opinion today seems no longer to support this view. And birds are certainly responsible for the distribution of the seeds of many trees and plants. There are many examples of the converse, of the effect of man's activities on birds. One of the most striking and well-known is that of the Corncrake (*Crex crex*) which was common in the hayfields of England in the last century. The introduction of earlier seeding grasses for the hay and of mechanical reapers has so reduced the acreage of grassland suitable for it to nest in that this is thought to have contributed largely to the decline of the Corncrake in many parts of England to-day.

2. The Study of Habitats

There is much useful work which can be done by the amateur who has neither the qualification, nor the time, nor the inclination to join with others in a full ecological survey. In the forefront is the study of habitats.

Plant ecology got away to a much earlier start than did animal ecology, and the geographers and plant ecologists have worked out from a mass of observations the major vegetation types for most of the world. The kinds of plants and trees that will grow in any particular place depend on many physical factors, such as the suitability of the soil and the climate. Palm trees, for instance, can grow only within certain limits of heat and humidity, and where these limits are passed, either through distance from the equator, elevation or dryness of the soil, no palms are to be found. The limits of their range can therefore be plotted fairly accurately on a map.

In the delta area of Bengal are large areas of land devoted to the growing of paddy and jute, liberally interlaced with patches of mixed jungle. If the species of plants and trees to be found in these areas are compared with those growing in the Irrawaddy Delta, some 500–600 miles away, they are found to possess many common characteristics, one of the major ones being that they require a great deal of moisture. Further to the west of the Bengal delta region, where the south-west monsoon does not carry quite such a heavy rainfall, the plant associations are all of a kind requiring less moisture for their support. By careful comparison of the plant associations in different parts of India, combined with a study of the geology and soils and particularly of the climatic conditions, it has been possible to plot on maps the areas where the plant associations have enough common characteristics to be considered as belonging to one particular type of vegetation. In each of these general types certain kinds of plants and trees are found to be dominant. And in each of them will be found many different local or minor associations possessing recognisable characteristics of their own, in each of which different kinds of plants and trees may be dominant. We speak, for instance, of teak forest or a mango or palm grove, when the dominant trees are teak or mangoes or palms; but other plants and trees are nearly always to be found in the same association, though to a lesser extent than the dominant species.

In the study and analysis of the birds to be found in these minor and major plant associations or habitats there is a great deal of scope for the bird-watcher. That different associations of birds are to be found in different habitats is almost an axiom. Compare the birds to be found in an extensive bamboo brake with those of the luxuriant Bengal jungle, with its rich undergrowth, or those of a Himalayan pine or rhododendron forest, and they will be seen to be quite different. Some species, however, may occur in each and much has still to be learnt about the exact habitats in which any given species can be found and the use to which each is put.

E. M. Nicholson in 'The Art of Bird Watching' (Witherby, London, 1931) has compiled a tentative classification of the types of habitat occurring in the British Isles, and with patience and co-operation from others his method could quite well be applied to the habitats to be found in any part of the world. Broadly he divides all habitats into certain major categories, e.g. a Coastal Group, an Inland Water Group, a Mountainous and Waste Land Group, (in India this could more satisfactorily be divided into two separate groups), a Woodland Group, a Cultivation Group, and a Civilisation Group. These main groups are subdivided. The Coastal Group, for instance, is composed firstly of the different kinds of rocky beaches, secondly of the various kinds of beaches without rocks, and thirdly of miscellaneous types such as sand dunes, salt marshes and so on. Each of these minor habitats is given an index number composed of a letter referring to the class of habitat and a number referring to the specific type of habitat. The following is an extract from his Coastal Group:

Rocky beach, with precipitous chalk cliffs. *Type*: Beachy Head, Sussex	A 2
Rocky beach, with Devonian cliffs. *Type*: Baggy Point, Devon	A 5
Shingly beach, without cliffs. *Type*: Pevensey Bay, Sussex	B 2
Muddy or sandy beach, without cliffs	B 3
Sand dunes	C 1
Salt marsh. *Type*: Wells-next-the-Sea, Norfolk	C 6

In this paper I include India, Pakistan and Burma in the title 'India' for the sake of brevity; after all, birds can hardly be expected to recognise political boundaries. A larger number of major vegetational regions is represented in India than in the British Isles, and in applying Nicholson's system to Indian habitats it would probably be helpful to prefix a second index letter to signify the major vegetational region concerned.

H. G. Champion (1936) has worked out a comprehensive provisional classification of forest types occurring in India based on four temperature zones, tropical, sub-tropical, temperate and alpine, each subdivided according to moisture conditions as reflected by the relative importance of evergreen, deciduous and thorny trees. His main divisions are as follows :

Moist Tropical Forests.

Group 1. Tropical Wet Evergreen Forests.
Group 2. Tropical Semi-evergreen Forests.
Group 3. Tropical Moist Deciduous Forests.

Dry Tropical Forests.

Group 4. Tropical Dry Deciduous Forests.
Group 5. Tropical Thorn Forests.
Group 6. Tropical Dry Evergreen Forests.

Montane Sub-Tropical Forests.

Group 7. Sub-tropical Wet Hill Forests.
Group 8. Sub-tropical Pine Forests.
Group 9. Sub-tropical Dry Evergreen Forests.

(Montane) Temperate Forests.

Group 10. Wet Temperate Forests.
Group 11. Himalayan Moist Temperate Forests.
Group 12. Himalayan Dry Temperate Forests.

Alpine Forests.

Group 13. Alpine Forest.
Groups 14 and 15. Alpine Scrub.

These groups he subdivides into their various characteristic components and he also lists the subsidiary edaphic and seral types occurring in each main group. Anyone proposing to undertake any ecological work which involves jungle of any description would do well to study this paper beforehand and to decide into which category the jungle concerned falls.

Champion's classification covers only the forest types and it would be a very useful preliminary to future ecological work if an exhaustive (even if only tentative) classification could be made of all other main habitat types occurring in India, and approved by some body of standing in order to minimise the risk of confusion in later comparative work.

3. HABITAT SURVEYS

Although information is needed on all kinds of habitats, one should, in selecting a habitat for survey, choose one that can be covered adequately with the resources at one's command. A patch of jungle may appeal as containing more kinds of birds than are found among paddy-fields, and therefore being on the face of it more interesting, but it is infinitely more difficult to survey it adequately. Until one has worked out one's own technique on easier habitats it is wiser not to attempt a comprehensive survey of so difficult a subject as jungle or scrub if one is aiming at detail and accuracy, as the results will probably be neither accurate nor complete and may well be misleading.

It is advisable to select a habitat that is characteristic of other districts as well, so that it may be used for comparative work later on, though surveys of isolated and non-recurring habitats are still valuable in view of the paucity of records so far collected, particularly if it is one which is likely to disappear eventually. Another point to bear in mind is that what are natural boundaries to us may well be 'highways' or gathering points for the birds we wish to study. A hedge or a continuous line of bushes may be a serious obstacle for man (and therefore a convenient boundary to his activities) unless there are gaps through which he can pass, but it is likely to be the headquarters of many birds.

The type of habitat to survey must inevitably depend to a great extent on one's resources and qualifications and objects. If one is working with other specialists as a team with the object of undertaking an intensive and exact study of the structure of a community, one must of necessity choose a somewhat limited area. On the other hand, if one is working entirely alone and one's opportunities for field work are restricted or irregular, it is probably wise to limit one's object to compiling a comprehensive list of all the birds seen in the district. In this case a larger area can be covered, but one should be prepared to sub-divide it into its component minor habitats and to try to disentangle the real use to which each one is put by the birds seen there. If one moves about the country from time to time similar methods can be applied to each place visited and interesting comparisons can later be made between the various habitats covered. It is useful when doing this to work out a formula or 'pro-forma' for the form and order in which one's reports are to be couched, as this facilitates comparisons later on.

In carrying out a general survey of a larger area it will probably be found that it comprises certain minor features which cannot easily be separated as distinct habitats and these can be treated as part of the surroundings in which they stand, provided that this is made clear in one's records. In Bengal, for instance, the villages are liberally prinkled with tanks, which are the resort of kingfishers, pond herons and so on; the tanks are the chief attraction to these birds, though in their comings and goings they use the surrounding habitat in which the tanks stand, and many of the other birds living in the neighbourhood go to the tanks to drink and bathe. These tanks are so numerous and so small that it is very difficult to separate them satisfactorily from the surrounding habitat.

In studying any particular habitat the first thing to be done is to describe it fully and accurately, and in this it is a great advantage if the help of a competent botanist can be enlisted to describe the vegetation, an entomologist to deal with the insects, and of other specialists to cover such matters as the local climatic conditions, the fauna, and the soil and geology. A team of observers, each one competent in his own particular field, is ideal for any habitat survey, and the combined knowledge of such observers as are available may be sufficient to bridge the gap left by the absence of, say, a geologist. Even so, a lot of useful work can be done by one man working on his own, provided he is observant, accurate and knows his own limitations.

Many features in any habitat change during the course of a year and full records should, of course, be kept of these as they may well affect the bird life. Plants come into flower and fruit, the leaves of some of them fall leaving the branches bare and a carpet of dead leaves on the ground beneath, which provides cover for insects; paddy is planted, flooded and harvested and all these changes may in some way or another influence the use to which the birds put the jungle or the paddy-fields. The metereological records should include temperatures, rainfall, humidity, wind, cloud and so on in order to provide a comprehensive record of the weather experienced during the survey period. Some animals are known to be seen more often in a dry season, some plants thrive and fruit better in a wet one, but we know little of the limits within which dryness and wetness are effective.

The natural complement to a full description of the survey area is a map or plan of it. More often than not it is necessary to prepare one's own sketch plan and this should be large enough to show all the important features clearly. If the survey area comprises more than one kind of minor habitat, these should be shown on the plan by means of different kinds of shading or hatching, or better still by the use of different coloured inks. The writer has found it very useful to give each prominent feature an identity number or letter. In studying a group of six fields, for instance, each field will be given a number, and the corners and centre points of each will be given a letter. This is much simpler than having to refer to 'the middle field on the eastern side of the area'; and it is easier and shorter to refer to 'Point A', or merely to 'A' rather than 'the south western corner of the north eastern field'. One can use one's time in the field more profitably in observing than in repeatedly writing down long terms which are constantly recurring, and provided one's records are accurate it does not matter how abbreviated a code one uses. In surveying small areas, where the number of species likely to be met with is not large, it is also useful to make a list of all the species one may reasonably expect to see there and to give each one a code number or letter. The key to this, with a small copy of the sketch plan, should be written down at one end of the field note book, so that one always has it with one for reference. It is surprising how quickly one evolves one's own code and learns it by heart.

Before embarking on any survey it is a good plan to formulate certain guiding 'rules'. Are you, for instance, going to include birds seen only flying over, and if so how are you going to refer to them in your notes and in your final report? How do you propose to deal with mixed hunting parties, which are only passing casually through the survey area? Are you going to attempt periodic counts of numbers? If so, they will require a special set of rules of their own. The making of censuses is outside the scope of this paper and anyone interested is advised to look up the reports of past censuses. Decide on these points before starting on the actual survey, so that your records may be consistent throughout.

Having selected the survey area, made a sketch plan of it, and written down a full description of the habitat, one can then begin a survey of the birds. If one is aiming at great exactitude and a detailed result, the area should be inspected at frequent intervals preferably every day, and as far as possible one's visits should take place at the same time or times each day. This is not always possible, nor is it always essential if one is aiming only at a more general result. A small note-book should always be carried in the field and the observations entered in this during or immediately after the visit to the survey area; memory dulls one's observations very quickly and accuracy may often be lost in a matter of an hour.

Some years ago the writer carried out a survey of the birds on a farm in southern England through which he passed nearly every day on his way to and from the office; this survey lasted about six years. It was by no means an ideal survey as it had to be moulded to fit the conditions under which it was made. The method adopted was to give each field an identity number, and each prominent feature (including the centre point of each field) was allotted a code letter. Another series of code letters and numbers was used for the kinds of birds usually seen. The use of these codes very quickly became automatic and the saving in time and space was enormous. Having noted in the field note-book the date and hour of the visit, any agricultural operations which were taking place, the weather and any special incidental items, a short record was made of each species seen, its numbers wherever possible, and where seen. In the case of small birds, such as larks, it was quite impossible to estimate their numbers during the 10–15 minutes in the survey area, which was usually all that could be spared, and comments had to be in such general terms as 'a few', 'several', 'a flock of about 20 in Field I and a few in III', and so on. In the case of larger birds, such as Rooks (*Corvus frugilegus*), and Lapwings (*Vanellus vanellus*), an attempt was always made to count them, or at any rate to estimate their actual numbers, and it was surprising how quickly one learnt to give an estimate within about 5 per cent of the correct number. At the end of the survey, the records were analysed in an attempt to show the use made by the birds of each kind of cultivation, as well as the seasonal fluctuations. For the larger birds graphs were drawn for each species, based on the largest number seen each week, and these suggested an interesting annual rhythm in the numbers.

It is not always possible to carry out such an intensive survey as this and one must work out one's own technique to suit the circumstances. The habitat in the survey mentioned above was a simple one, consisting only of arable and pasture land covering about 150 acres, without the complication of any woodland. While serving in India during the recent war, when opportunities of bird watching and of writing up records were very irregular the writer adopted a different technique; this has already been shortly described in his paper on 'Some Bird Associations of Bengal'.

Whatever method be used for keeping records of the survey, it is important to evaluate one's observations in order to avoid giving a distorted impression to others. If one is not absolutely certain of the identity of a bird seen it is essential that this be made clear in the records. There are many occasions on which even the most experienced ornithologist is not absolutely certain beyond all doubt of the identity of the bird he has seen, and there is nothing to be ashamed of in confessing one's uncertainty. Here again the use of signs and symbols can save a lot of time and trouble. For example, a tick can be used for a bird of whose identity one is positive; a star for one whose identity is uncertain; a cross for a 'possible' and so on. The same rule applies in recording plants and trees, animals and insects.

The records should always include a note of the time and conditions under which they were made, and of all incidental matters which might affect either the birds themselves or the validity of the record. Observations with the naked eye from a moving train or car are obviously more open to mistake and inexactitude than observations made with field glasses at only a few yards range. And the fact that aircraft are constantly taking off and landing at an aerodrome while observations are being made there may well affect the numbers and kinds of birds seen.

Although bird ringing was designed primarily to assist the study of migration, coloured rings can be a great help in studying a very small area. The British Trust for Ornithology (91 Banbury Road, Oxford, England) has published a very useful Field Guide (No. 1) on 'Trapping Methods for Bird Ringers' by P. A. D. Hollom[1], and this is well worth consulting by anyone who proposes to use ringing as an aid to a survey.

4. OTHER SURVEYS

Another method which can give useful results if properly organised and controlled, where a continuous survey is not possible, is the taking of thorough samples at longer intervals. The margin of error is, however, inclined to be greater than in a 'running survey' and there is a danger of missing trends.

Yet another method that can be usefully employed in habitat surveys is the transect. This is a detailed record of all birds seen on, say, a long train journey, or a voyage by boat up a river, or a long trek on foot. In each case, of course, an exact note is made of the habitat through which one happens to be passing at the time each bird is seen. Transect reports might have a good deal of value if there were a large number of them covering the same route at all times of the year, but their very nature is inseparable from incompleteness and inexactitude, though observations taken on a trek on foot will naturally be fuller and more accurate than those made from a moving vehicle.

In recent years some extensive surveys have been carried out into the distribution and habitats of particular species. The Lapwing Habitat Enquiry, organised by the British Trust for Ornithology in the British Isles in 1936 and 1937, is a good example. This survey was carried out by numerous observers all over Great Britain, who recorded their observations on special forms. The results were correlated and analysed by E. M. Nicholson (1939). The study of the habitats of a particular species or group of species would be an interesting task for someone with few restrictions on time or travel, but really a survey of this kind requires the co-operation of a large number of observers in different parts of the country, especially in so large a country as India, working under some central direction. A very useful preliminary would be the cataloguing of all the different habitats occurring there.

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[1] Noticed on p. 773 of Vol. 49 (4) of the *Journal*—April 1951.—EDS.

It sometimes happens that a river changes its course or a lake dries up, uncovering 'new' land which is bare of all vegetation. A somewhat similar thing happens when a hillside is scarred by a landslide. Plant ecologists distinguish between the two cases, but there is no need to do so here. Within a short time wind-blown seeds germinate on the new earth and these quickly cover it with an open vegetation with plenty of spaces between the plants. In another season these gaps will have been closed by the growth of the plants already established and the arrival of other seedlings, and then the struggle for existence really begins. If such an area is watched year after year it will be seen that the character of the vegetation changes as the plants become more congested and new layers of humus are added from the fallen and decayed leaves. One particular plant will succeed better than the others and will tend to crowd the others out. As time goes on the small first stage plants will be succeeded by larger plants and trees and eventually the climax vegetation (usually similar to that of the surrounding country) will be reached beyond which the succession does not go. Plant ecologists call this succession of vegetation a 'sere'. As the vegetation changes so the bird associations found there will change, and a complete survey through all the stages of a succession would be a most valuable contribution to ecology.

A rather similar kind of succession can be found where virgin jungle is cleared and the ground turned over to crops; or where a town is extended outwards into what had previously been countryside. Forest fires, earthquakes, landslides, prolonged flooding, extreme drought, plagues of insects and so on can all initiate a greater or lesser vegetational succession in which the sequence of bird associations is worth studying. Change is always taking place and the record of how any particular change affects the bird population is interesting and valuable.

In Bengal and other parts of India and Burma vast areas of paddy land are flooded every year as part of the regular cultivation of the crop. Flooding on such a large scale is certain to produce reactions among the avifauna of the districts affected and also the surrounding districts, and this is a subject which would be well worth organised study. Everyone keeping accurate records for his particular district would be making a valuable preliminary contribution.

Certain trees and crops prove an attraction for some birds. When the Red Silk Cotton trees (*Bombax malabaricum*) are in bloom, numbers of birds can be seen about the large flowers. Whether they are after the nectar, the dew collected in the cup of the blossom, or the insects attracted by the nectar is not known for certain, and this is a question which photography might well be able to answer. Probably the truth lies in a combination of all three, as not all of the many species of birds seen at the flowers are habitual insect-eaters. Whatever the attraction, there is no doubt that one of the results is that the birds assist in the pollination of the flowers. Many kinds of birds are also attracted by the tapping of toddy palms, but again whether by the liquid or the insects attracted by the liquid is not certain. Probably each is an attraction to certain kinds of birds. The writer has certainly seen a Tickell's Flowerpecker (*Dicaeum erythrorhynchum*) catching the drops of liquid as they fell.

Commensalism is another allied subject that has so far received comparatively little attention. Cattle Egrets (*Bubulcus ibis*), mynas and wagtails can often be seen foraging about grazing cattle and it is known that they obtain benefit from doing so in the form of insects disturbed from the grass by the movements of the beasts. Just what benefit birds find from foraging or consorting together is less clear. What, for instance, is the underlying reason for small birds to join together in mixed hunting parties, or for Rosy Pastors (*Pastor roseus*), for instance, to join together in flocks of their own kind, outside the breeding season? Is the only reason that wagtails roost together the shortage of suitable roosting places? Why do birds nest and live in colonies like the Weaver Birds? These are all questions to which no final answer has yet been found.

5. CONCLUSION

Bird ecology is only in its infancy and there is enormous scope for experiment and research. Teams of observers, each one an expert in his own subject, are ideal for the full study of a limited area and the structure of the community inhabiting it, but a single watcher working on his own can still do a lot of useful work. The control of some central body directing the activities of numerous observers spread over the whole country is essential to the success of some kinds of investigation; in the British Isles this function is fulfilled by the British Trust for Ornithology. This central body should also act as a clearing and storage house for individual reports and records, even if they are never published, where they may be available for reference and comparison by other workers. In its present state almost any contribution to ecological knowledge is likely to be useful, provided only that it is accurate.

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SUCCESSION OF THE MANGROVE VEGETATION OF BOMBAY AND SALSETTE ISLANDS

BY

B. S. NAVALKAR

(*Department of Botany, Institute of Science, Bombay*, 1)

(*With two plates*)

INTRODUCTION

While studying the ecology of the mangrove vegetation of Bombay and Salsette Islands, it was thought that it would be interesting to study the succession of the mangroves and its governing factors. Previously Blatter (2) studied the mangroves of Bombay and its biology; Biswas (1) made a comparative study of Indian species of *Avicennia*. Similarly Cooke (3) has described some of the species in his Flora of the Presidency of Bombay. But no attempt had so far been made to trace the succession of the mangroves. Due to earlier detailed study of rocks, soil salinity, soil humidity and biotic factors of the mangroves by Navalkar & Bharucha (4), it has been possible to trace out, in the present work, the different stages of the succession.

The existing mangrove vegetation in Bombay and Salsette Islands is spread on the shores of the creeks and coast of the surrounding sea. These shores of the creeks are an alluvial deposit of recent formation, as has been previously mentioned in the earlier work (4).

THE VARIOUS STAGES OF MANGROVE VEGETATION

The succession of the mangrove vegetation is governed by four factors: (1) Disintegration of rocks, (2) Soil salinity, (3) Soil humidity and (4) Biotic factors.

Due to the biotic influence, the mangrove vegetation is fast disappearing from the coasts of these islands; plants are either cut by the inhabitants near by for fuel, or uprooted and eaten away by cattle, as fodder. In Bombay there is a constant cutting and grazing of the mangrove vegetation, so that plants like *Avicennia alba* Blume, which normally grow into trees, are never seen here except as shrubs. This intensive cutting and browsing has resulted in the almost total elimination of some of the species; *Lumnitzera racemosa* seen on the shores of Bandra in 1934, now is there no more. Another important biotic factor resulting in the gradual disappearance of this vegetation is sewage. At Worli, Dadar and Bandra near the mouths of the sewage disposal pipes even hardy species like *Avicennia alba* Blume are unable to grow, and it will be interesting to find out what exactly is the factor responsible for this.

There are about 12 mangrove species round about Bombay and Salsette. Of these only one seems to be predominant, viz. *Avicennia* *alba* Blume. Hence this mangrove association can be named as *Avicennia alba* Association, consisting of the following species:

(1) *Avicennia alba* Blume.
(2) *Avicennia officinalis* Linn.
(3) *Acanthus ilicifolius* Linn.
(4) *Aegiceras majus* Gaertn.
(5) *Bruguiera gymnorhiza* Lam.
(6) *Ceriops candolleana* Arn.
(7) *Excaecaria agallocha.* Linn.
(8) *Lumnitzera racemosa* Willd.
(9) *Kandelia rheedii* Wight. & Arn.
(10) *Rhizophora mucronata* Lam.
(11) *Sonneratia acida* Linn.
(12) *Sonneratia apetala* Ham.

First Stage.

(*a*) This association at its optimum stage of development is to be seen on the foreshores of the creeks, where the tidal water bathes the vegetation twice daily, in other words this association lies between low and high tide lines. But it is rarely that all the species mentioned above are found at a time. It is only in such far away places as Ghodbunder that there are possibilities of finding a complete association. But this, too, has in recent years been made impossible by man. Ruthless cutting has resulted in the destruction and disappearance of almost all the species except *Avicennia alba.* So that to speak of *Avicennia alba* Association today is a misnomer. It is for this reason that in the present study not much attention has been paid to other species except *Avicennia alba.*

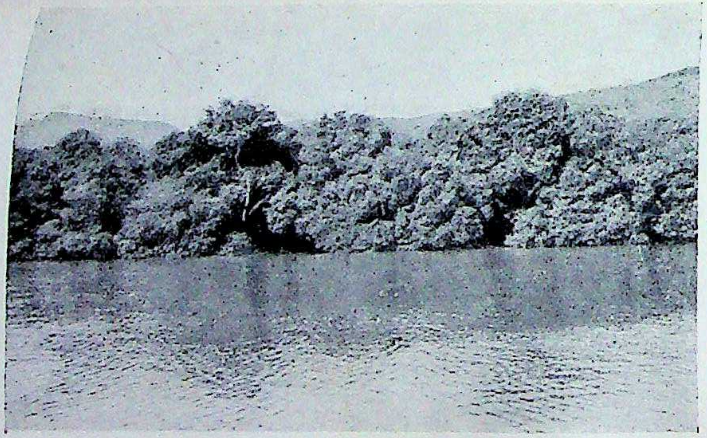
Second Stage.

(*b*) In those places where the shore is broad and extends inwards passing the high tide line, the vegetation changes with decreasing salinity of the soil. As mentioned above, due to the great influence of cutting, most of the species have disappeared from the first stage except *Avicennia alba* and *Acanthus ilicifolius.* These persist with increasing distance from the shore due to their high germination capacity and form the second stage of succession. This means that this stage of *Avicennia alba* and *Acanthus ilicifolius* is found on higher ground and in less saline soil than the main association.

(*c*) However it is found that in those areas where sweet water from rivers mingles with that of the creek, as at Mumbra, where Ulhas river flows, the main association is deflected to a stage dominated by *Ceriops candolleana* and *Acanthus ilicifolius.*

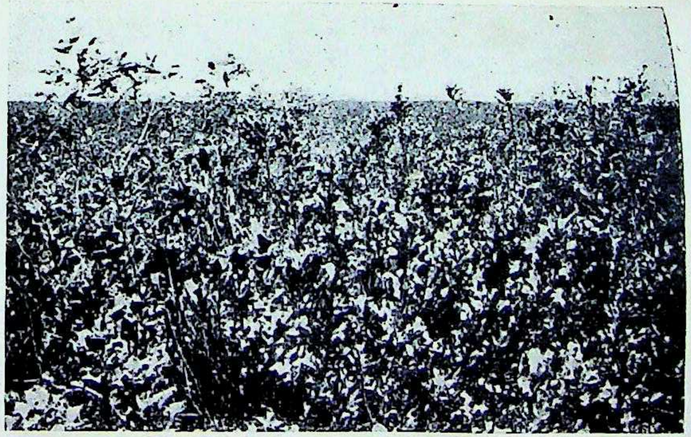
Third Stage.

(*d*) With increasing biotic factors and greater distance from the shore *Acanthus ilicifolius* disappears and the 2nd stage then turns into a pure stage of *Avicennia alba.* This is probably due to the hardiness of the plant and its higher range of adaptability, for it is found also on slightly weathered rocks at Colaba, Mahaluxmi, and Worli.



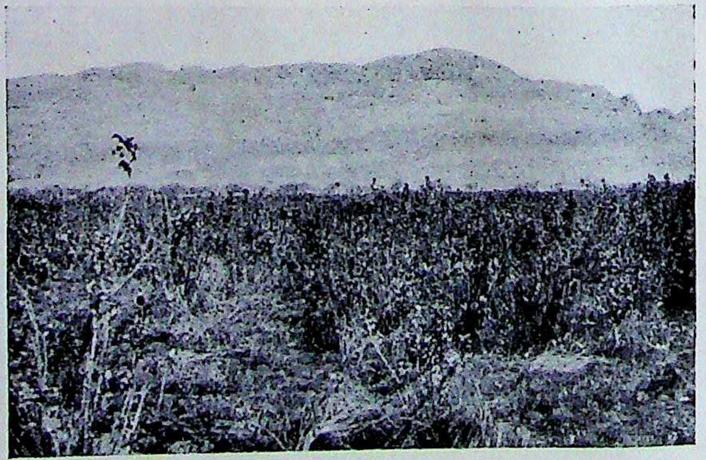
1ST STAGE.

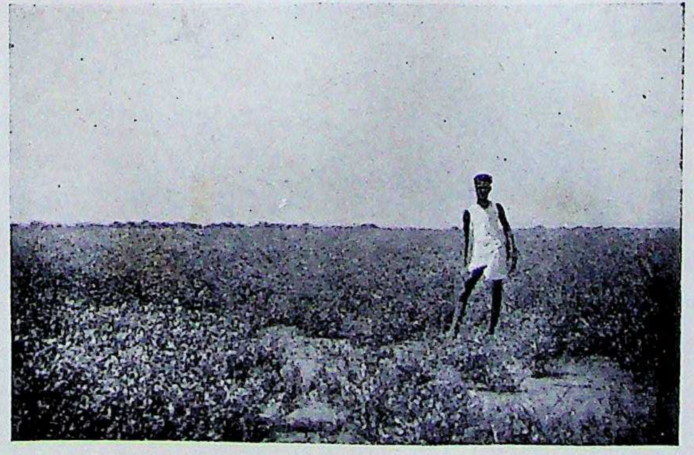
Avicennia alba Association (optimum stage) from Uran — near Bombay.



2ND STAGE.

Avicennia alba and *Acanthus ilicifolius* from Bandra.





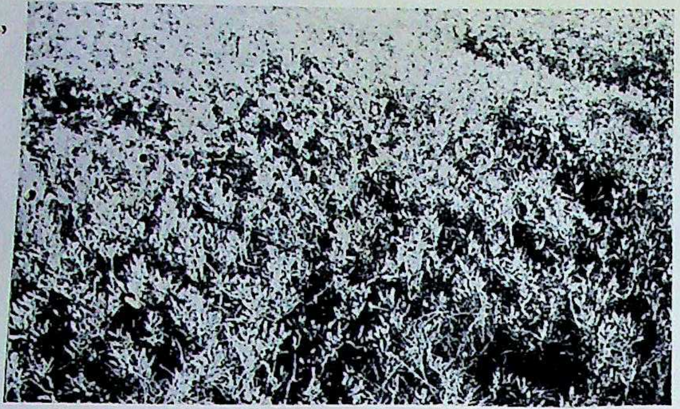
Photos *Author*

2(A) STAGE.

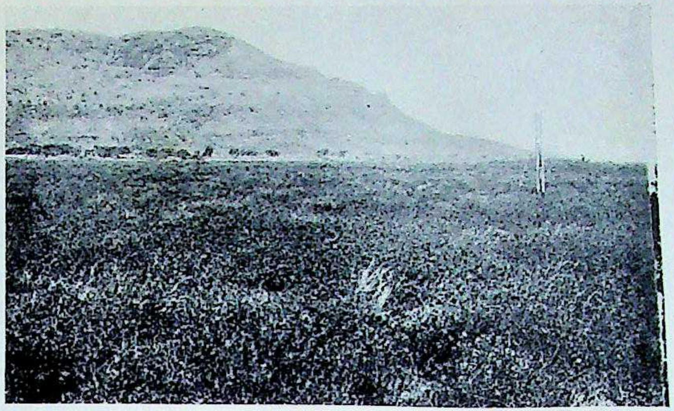
Ceriops candolleana and *Acanthus ilicifolius* from Mumbra.

3RD STAGE.

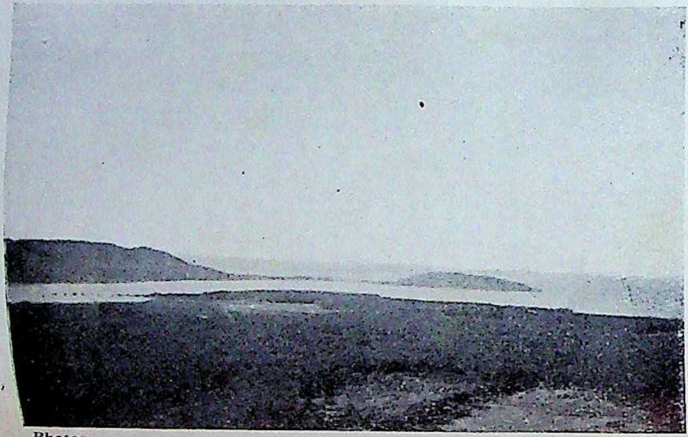
Avicennia alba from Bandra.



4TH STAGE.
Sesuvium portulacastrum from Vadala.

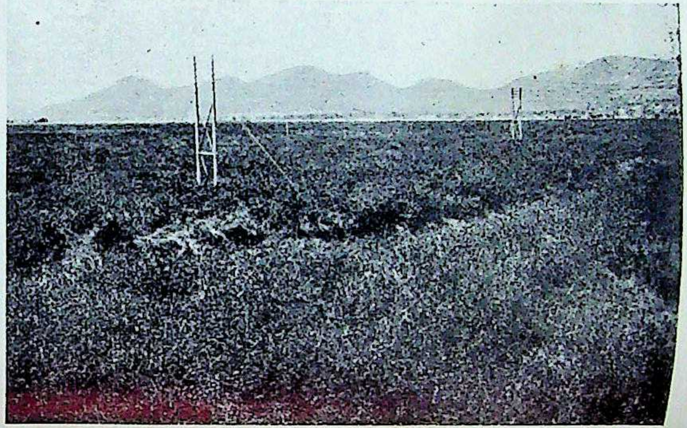


5TH STAGE.
Sesuvium portulacastrum and *Aeluropus repens* from Mumbra—Diwa.



Photos

6TH STAGE.
Aeluropus repens and *Paspalum vaginatum* from



Author

7TH STAGE.
Clerodendron inerme from Mumbra—Diwa.

Fourth Stage.

(*e*) When the distance from the shore is sufficiently big and where the tidal water bathes the soil for a short time *Acanthus ilicifolius* shows signs of disappearance and is replaced by *Sesuvium portulacastrum* Forsk. As a result one finds big patches of land covered completely by this plant at Bandra, Mahim, and Vadala.

Fifth Stage.

(*f*) With increasing height and decreasing salinity above sea level, *Sesuvium portulacastrum* is invaded by the grass, *Aeluropus repens* Parl. These two form the 5th stage of succession.

Sixth Stage.

(*g*) With increase in the above two factors, *Aeluropus repens* Parl. with *Digitaria marginata* Link., *D. fimbriata* Link., *Paspalum vaginatum* Sw., *Sporobolus glaucifolius* Hochst., *S. orientalis* Knuth., *S. pallidus* Boiss., *Cyperus compressus* Linn., *C. rotundus* Linn., *Fimbristylis ferruginea* Vahl., *F. polytrichoides* Vahl., *Scirpus ferruginea* Vahl. form the halophytic pastureland.

Seventh Stage.

(*h*) Finally may be mentioned the most arid stage of succession and one which can thrive in soils with very little salinity, the *Clerodendron inerme* stage. This stage is found generally on the bunds of salt pans and includes plants like *Suaeda fruticosa* Forsk., *Arthrocnemum indicum* Moq., *Atriplex stocksii* Boiss, and *Salvadora persica* Linn. That the plants of this stage thrive well in least saline soil, is proved from the fact that *Clerodendron inerme* Gaertn. has become a hedge plant in Bombay gardens.

The succession traced above, is diagrammatically represented in the following table:

SUCCESSION OF VEGETATION IN THE MANGROVE SWAMPS OF BOMBAY AND SALSETTE

Soil	Anthropozoic influence	Stages of Succession
Blackish or grayish of clay and salt. Always inundated and swampy, lying between low and high tide marks.		1. *Avicennia alba* Association (Optimum Stage)
High level of ground with less salinity of the soil.	Cutting and burning	2. *Avicennia alba* and *Acanthus ilicifolius* Stage.
Areas where sweet water mingles with creek water.		2(*a*). *Ceriops candolleana* and *Acanthus ilicifolius* Stage.
Greater distance from shore and weathered rocks.	Increase in biotic factor	3. *Avicennia alba* Stage.
Still greater distance from the shore.		4. *Sesuvium portulacastrum* Stage.
Increase in height above the sea level and decreasing salinity.		5. *Sesuvium portulacastrum* and *Aeluropus repens* Stage.
Still increase in height above the sea level and decreasing salinity.		6. *Aeluropus repens* and *Paspalum vaginatum* Stage.
Increasing aridity and very little salinity.		7. *Clerodendron inerme* Stage.

SUMMARY

In the present study an attempt is made to trace the different stages of succession of mangrove vegetation of Bombay and Salsette islands. The mangroves are mostly dominated by *Avicennia* species. The different stages of succession are traced and it is found that the nearness of sea and consequently the salinity of the soil, together with the biotic factor, are chiefly responsible for the succession.

ACKNOWLEDGEMENTS

My sincere thanks are due to Professor F. R. Bharucha, F.N.I., D.Sc., for suggesting and taking interest in the work, and to Professor S. P. Agharkar, F.N.I., for general guidance and suggestions from time to time. I have also to thank Rev. Fr. Dr. H. Santapau for correcting the paper critically and making useful suggestions.

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REVIEW

1. NATURE THROUGH THE YEAR. By Frances Pitt. Pp. 300. Macmillan & Co. Ltd., London (1950). Price 18*s*. net.

Miss Pitt's latest book appears to be a reprint of articles published week by week through the year. She gives a good picture of the course of life for birds, insects and other creatures season by season in the English Midland counties. The book is enlivened with numerous charming photographs.

Miss Pitt has an easy chatty style She wanders from one subject to another. There is no attempt to explore any matter to its roots. She is content to make her comments, often pertinent, and then to pass on to another topic. But the book is full of country lore.

It could advantageously have been more carefully edited for publication. We are told the same facts about badgers and about rats two or three times. The proper names for the male and female swan recur. There is, indeed, quite an annoying amount of vain repetition.

Another book of somewhat similar character came into my hands recently. 'The Strange World of Nature' by Bernard Gooch (Lutterworth Press, 10*s*. 6*d*.). Mr. Gooch, like Miss Pitt, finds frogs and spiders just as fascinating as tits and woodpeckers. But Mr. Gooch, without ever becoming dull or difficult to follow, penetrates much more profoundly into the mysteries of natural life. Miss Pitt, like most of us, takes her morning walk, stops for a few moments here and there, comes home again and writes her report of things seen and heard. Mr. Gooch, though he does not tell you so, has the capacity for concentrating all his faculties, hour after hour, on one seemingly trivial aspect of natural life. And what amazing discoveries he makes! Slugs, we learn from him, suspend themselves in the air on a self-produced thread of slime, in order to mate with one another. Snails shoot a cupid's dart at the intended mate. Wasps sometimes use a small stone as a tool for hammering the earth. You do not believe it? Then read Mr. Gooch's book and I think he will convince you.

Miss Pitt's book serves pleasantly enough to pass an idle hour. But Mr. Gooch leads you through magic casements into undiscovered worlds.

H.G.A.

The following books have been added to the Society's Library since April 1951:—

1. CHECK-LIST OF BIRDS OF THE WORLD. Volume VII. By James Lee Peters. (Museum of Comparative Zoology, Cambridge, 1951).

2. A DICTIONARY OF BIOLOGY. By M. Abercrombie, C. J. Hickman and M. L. Johnson. (Penguin Reference Book, 1951).

3. ANIMALS WITHOUT BACKBONES. Volumes I and II. By Ralph Buchsbaum. (A Pelican Book, 1951).

4. BEES—THEIR VISION, CHEMICAL SENSES AND LANGUAGE. By Karl von Frisch. (Cornell University Press, 1950).

MISCELLANEOUS NOTES

1. THE INDIAN WILD DOG

Notes on Lt.-Col. R. W. Burton's article published in Vol. 41 (4): 692-715.

Wild and Pariah Dogs, Page 692. I know of a case of a smallish red pariah bitch that used to play with the wild dogs whenever they came near the village cattle. Unfortunately no record of any inter-breeding was obtained.

Another black and white pariah dog from the coolie lines used to follow the wild dogs if they ran a sambar anywhere near, and used to return full fed, so the coolies used to follow it when it went for another meal, hoping to get a bit of meat themselves. When it met the pack it used to lie on the ground very apologetically and whine.

Two Species, Page 693. The Mysore shikaris (not professional) near the Western Ghats used to say there were two species, and gave the name of 'whistling dog' to the smaller one, probably because being young their call was shriller. Professor Littledale's suggestion seems correct, and the big packs were probably composed of several three-quarter grown litters. The largest dog I ever saw was a solitary, well known to the coolies who often met him hunting on his own, but it was not shot.

Pairs were also seen hunting together, and more often they were running a barking deer than a sambar. Once a big pack was apparently beating a long strip of jungle, with two or three dogs posted at each gap in the ridge on one side, at which game would be likely to break, the other side of the jungle being estate.

Colouration, Page 695. I've never seen a completely white tip to a tail on the Western Ghats, only a few white hairs; but dogs very often had a white patch with red spots on one paw.

Litters, Page 697. I once took a litter of 11 cubs from an earth. The bitch came out in a beat, and got away wounded. Beaters reported the earth, and I sat over it and shot the dog, and then dug out the litter. There was no indication of two litters in the one earth. I tried to rear the cubs, but they were very wild and died off one by one, though one survived about a year.

Voice, Page 700. I found an empty .303 cartridge used as a whistle to be the best note for calling up dogs, pressure should be decreased at the end to give a wailing note, and dogs answered it especially if they had been scattered by a shot, or driven off a kill, and it usually paid to alter position and to take good cover.

Cattle killing, Page 703. I've known several instances of full grown cattle being killed by dogs, the worst being when a pack stampeded a herd of cattle which charged into a nursey under a pandal, and five or six cattle were pulled down in the nursery, and unfortunately only one dog was shot, as the cattleman only possessed a S.B. muzzle-loader.

Attitude to Mankind, Page 706. I remember two instances of coolies being treed by dogs. Two coolies tried to drive the dogs off a kill, but the dogs came at them snarling so they climbed trees, and stayed there till the dogs fed and cleared off. Another cooly met a pack on the cart road, which did not clear off when he shouted, but came on, so he climbed a tree, and the dogs sat around under the tree for a bit looking at him.,

I checked up on this by the tracks in the dust.

Wild *vs.* Domestic Dogs, Page 709. On two occasions I had my terriers chased by wild dogs, which only stopped when I rode at them shouting. Once a terrier running a line was killed and eaten, judging by the hair in the wild dog droppings. I have however seen a big solitary wild dog running from quite a small fox terrier, but the wild dog may have spotted me.

Toughness, Page 712. I confirm their toughness and vitality, and consider that proportionately they take more killing than any other animal in these parts.

YELLIKODIGI ESTATE, A. MIDDLETON
CHIKMAGALUR DISTRICT,
MYSORE STATE,
20th March, 1951.

2. A WILD DOG INCIDENT

One evening I went for a walk with our four dogs, a black cocker spaniel, two black and tan dachshunds, and a golden retriever. I emphasise the colour as it seems to have some bearing on this incident. We took a path through some thick bamboo jungle, and suddenly they all picked up the scent of something, and disappeared, barking excitedly. I had seen nothing, and thought they were on the scent of a hare as usual. I whistled, and after a few minutes the three black ones returned, tails down, and obviously very unhappy about something. They would not leave my side, and sat crouching as near me as they could get. This worried me somewhat, as the retriever was not mine. I was only looking after him while his owners were on leave in England. Moreover he was an old gentleman, nearly 11 years, and had two years previously been badly gored by a wild boar.

After about five minutes of silence, I heard him barking in the distance, and whistled to him again. This time he came, tail up, looking extremely pleased with himself. To my amazement he was leading a pack of wild red dogs, who had obviously accepted him as one of themselves. He came over to where I stood, and for a few seconds we all stood and looked at each other, the pack 15 ft. away, and our four, and myself. Then the wild ones turned and disappeared the way they came. I counted five, but there may have been more.

Another thing that impressed me was the polite manner in which they saw 'Bowler home', so to speak. He was obviously very thrilled at being accepted as 'one of the boys.' Why the other three dogs were so frightened, I cannot say. I can only assume they were the wrong colour to be recognised as the same species.

JOYCE C. WINTERBOTHAM

CHEMBRA PEAK ESTATE,
CHEMBRA P.O.,
VIA MEPPAD, MALABAR,
27th March, 1951.

3. REARING A BABY CEYLON GREY FLYING SQUIRREL (*PETAURISTA PHILIPPENSIS LANKA*)

(*With a photo*)

March 5th (1951) saw the arrival of a new and somewhat strange baby—a very young and helpless Grey Flying Suirrel of the local race *lanka*.

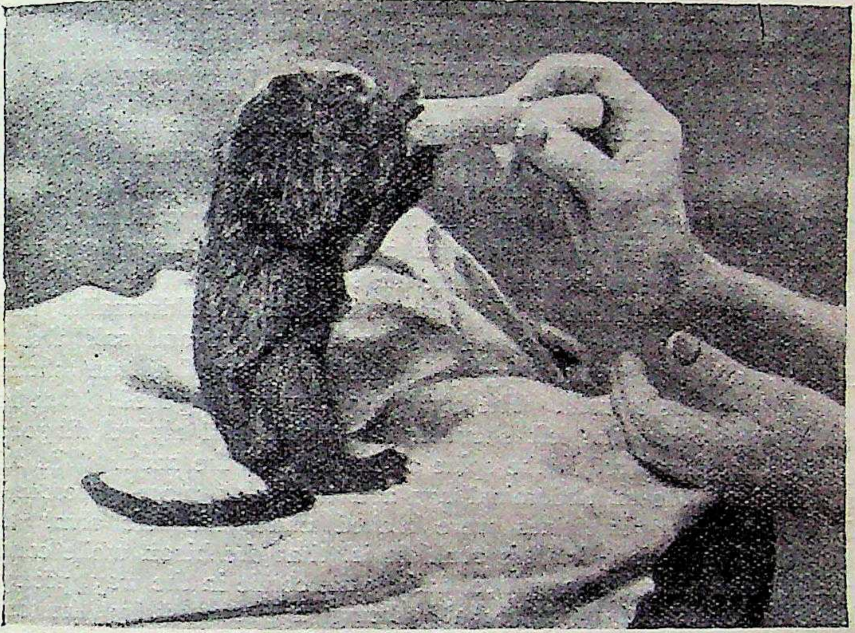
It was brought in while I was in my office, by a villager from below the estate (Galapitakande) who said that he had found it in a hole in a branch when he was cutting down a dead tree for firewood. He did not see the mother-squirrel so, presumably, she must have escaped, unseen, as soon as the cutting down started.

The baby flying squirrel was very young—probably little more than a week old—but I had no means of ascertaining his exact age. He just fitted nicely into the palm of the hand, as a warm, furry, greyish ball.

My wife took to him at once; he was so pathetically helpless, yet so attractive with his large dark eyes, and his long, black, furry tail wrapped round his little soft body. Preparations to feed and rear him were immediately made—although he looked a little young for hand rearing. A tin of Klim, another of glucose and a little calcium were produced, together with a glass tube-bottle, for use as a feeding bottle, with a piece of felt wrapped round it to form a feeding-funnel and mouth-piece. Felt appears to suit most young animals better than rubber as they can get hold of it and suck it more easily. Every two hours, throughout the day, from 6 a.m. to 10 p.m. was the routine to start with, but after a week or so longer intervals and larger feeds were given so that within ten days of his arrival he was having two teaspoons of Klim, two of glucose and a pinch of calcium at each feed, well mixed with hot water and allowed to cool off. To this was added, after the first week, a little mashed plantain, after it had been put through a sieve. When not feeding, he slept very soundly, loosely wrapped in an old, knitted, woollen shawl, in a small box-cage where he was as warm and as snug as he would have been with his own mother.

Right from the day he was brought to us he thrived on this diet, so that after three weeks or so he had more than doubled his size and was able to sit up, in a proper squirrel like attitude and grasp his feeding tube in both his little, hand-like forepaws.

Now, just two months after his arrival, he is a fine animal with a long, silky, grey coat, just the colour of Silver-fox fur, a long, bushy black tail and black limbs with little naked knuckles to his long slender forepaws. He is perfectly tame and lops along to meet his mistress, when he is out playing in the evening. No longer does he have to be hand fed; he feeds himself, selecting his food from a very mixed diet consisting of tomatoes, sweet-potatoes (yams), nuts, raisins and plantains, washed down with his usual Klim or other milk-powder, glucose and calcium from a bowl. Cow's milk he does not have as, curiously enough, cow's milk does not agree with the majority of small wild animals.



Young ♂ Ceylon Grey Flying Squirrel (*Petaurista philippensis lanka*) being fed with milk solution

Until the evening, he likes to lie sleeping in his covered-box, but as dusk falls he becomes active, if not lively, and hops around in his rather ungainly manner or climbs up anything handy—preferably cloths to a convenient shoulder. He is very gentle and confiding, but if alarmed he will grunt at the intruder in a curious Bandicoot-like manner and attempt to frighten him away. I have heard no other sound from him.

Flying squirrels of this species are to be met with in the well-wooded foothills of this neighbourhood. They are certainly not common, but being purely nocturnal they are probably more numerous than they appear. Although they are, perhaps, more plentiful in the lower foothills, they have been encountered even on the Horton Plains, at altitudes of over 7,000 feet.

TONACOMBE,
NAMUNUKULA,
7th May, 1951.

W. W. A. PHILLIPS

पुस्तकालय
गुरुकुल कांगड़ी

4. GAUR ATTACKING MAN

I thought you might be interested in the following account of an attack by a bull bison on a solitary coolie which ended fatally.

Between the Anamallai Hills and the High Range Hills, at an elevation of about 6,500 feet; there is a large stretch of grassy downs with small patches of shola on them. Through this country runs a short-cut of some 20 miles occasionally used by coolies though generally only parties travel together on account of the numbers of bison and elephants which are to be found there. At the beginning of March two coolies on their way back from the High Range came upon the body of a coolie who had come over ahead of them on his own. He had apparently come upon a solitary bull bison on the path just after he had crossed a small stream (which is a popular watering place for bison) and they believed he threw stones at it, though this is not certain.

The bison anyhow charged him and gave him a good tossing, and ripped him up a bit with its horns and then after trampling on the body to make sure of its job, it left the scene.

Mr. J. S. MacPherson the Asst. Manager of Akkamallai Estate who later saw the body on the spot, wrote to me and said that the coolie's cloth was found hanging in the branches of a tree (showing how high he was tossed). The body was very badly gored. One horn had entered below the left shoulder blade and had ripped diagonally upwards passing through the spine at the base of the neck. The other major injury was an abdominal one and was even more gruesome as his stomach and intestines were tucked under his left arm. Mr. MacPherson's theory for this accident is, that the bison while coming for a drink at its watering place, finding the coolie in the way, promptly charged and killed him, probably being aggravated by the coolie throwing stones at it (though I personally think that no sensible coolie would do such a thing). If anyone shoots the bison another reason might be found such as an old wound or something.

The particular solitary bull bison who lived in this locality was well known to me and certainly on the numerous occasions I met it, it never attempted to be aggressive. The only theory (other than the one above) that I can put forward is that the bison had been mauled by a tiger and later seeing the coolie mistook him for the enemy and proceeded to get his own back.

It is of interest to add that some two weeks before the above incident I shot a bull bison about 2 miles away from the scene, which had been very badly mauled indeed by a tiger about the face and neck—one of the healing scars being over 2 feet in length. This bison was in a herd of 19 and none of them appeared aggressive, least of all the bull which I shot.

Perhaps some more experienced person can put forward other theories?

ROUSDON MULLAI ESTATE,
DEVALA P.O.,
NILGIRI WYNAAD,
23rd April, 1951.

ANGUS F. HUTTON

5. THE GREAT INDIAN RORQUAL OR FIN-WHALE *BALAENOPTERA INDICA* BLYTH OFF UMARGAM (BOMBAY STATE)

The carcase of a whale—*Balaenoptera indica* Blyth, was washed ashore at Umargam on 14th May, 1951 (100 miles off Bombay on the B.B. & C.I. line) which had the following measurements.

Total length (tip of snout to tip of flukes) 74 ft.
do (do to centre of flukes) 68 ft.
Fluke 6 ft.
Height 5 ft. 5 inches.
Snout 13 ft. 6 inches.
Width just behind the head, between flippers 21 ft.
Flipper 6 ft. 1 inch.
Lower jaw 16 ft. 3 inches.

The carcase was in a high state of putrefaction rendering any anatomical examination impossible.

The last whale record off Bombay was that of an immature specimen—*Balaenoptera* sp.—stranded at Mahim on 12th April 1949 taping 20 ft., published in Volume 48, No. 2, pp. 358, by Mr. N. G. Pillai.

Bombay Natural History Society,
Bombay,
24th May, 1951.

V. K. CHARI.
Assistant Curator.

6. BIBLIOGRAPHY OF BIG GAME HUNTING AND SHOOTING IN INDIA AND THE EAST

[Published in Vol. 48, No. 2. (August 1950).]

Addenda

The following titles to be added :—

	Author	Title	Published
29 a.	Berg, Bengt ...	Pa jakt Enorningen. Deals with Rhinoceros and some other animals. 67 plates.	1932
29 b.	„ „ ...	'Tigrar'. Tiger and other animals, scenery and people. 68 plates.	1934
53 a.	Burton, Capt. R. G.	Tropics and Snows.	1898
58 b.	Carruthers, Douglas	Beyond the Caspian.	1950
73 a.	Cunningham, Col. A. H.	Indian Shikar Notes.	1929
77 a.	Demidoff, E. ...	A Shooting Trip to Kamchatka	1904
92 a.	Fawcus, L. R., I.C.S.	Report of the Game and Game Fishes Preservation Committee on the existing species of Game in Bengal including a specially interesting article on the Rhinoceros in Bengal.	1943
114 a.	Gordon Graham, B. N.	Hunter at Heart.	1951

	AUTHOR	TITLE	PUBLISHED
143 a.	*Journal of the Darjeeling Natural History Society.*	1923 to 1930. Title changed in 1930 to the *Bengal Natural History Society*, 1930 to 1949 and onwards (?)	
155 a.	Lambert, Cowley.	A TRIP TO CASHMERE AND LADAK (in 1874)	1877
169 a.	Mathias, H. V ...	FIVE WEEKS' SPORT IN THE INTERIOR OF THE HIMALAYAS.	1864
174 a.	Mohan Jai Ram Gir, Shri	USEFUL INSTRUCTION IN SHOOTING. (Printed in English and Hindi in parallel columns. Thirteen chapters, and a number of very amusing illustrations.)	1885
36 a.	Bloomfield, Col. Arthur ...	THE DOINGS AND DESTRUCTION OF THE MOST MURDEROUS ROGUE (C.P. elephant).	—
160 a.	Leveson, H. A. ...	HUNTING GROUNDS OF THE OLD WORLD. Part I. India; Part II. Circassia; Part III. Algeria; Part IV. Firearms Hints.	1878 (?)

CORRIGENDA

On page 235, under *Lydekker*, enter :—

6 a.	Lydekker, R. ...	CATALOGUE OF THE HEADS AND HORNS OF INDIAN BIG GAME bequeathed by A. O. Hume, Esq., to the British Museum of Natural History.	1913

On page 235. *Pigsticking*. Insert between the two entries :—

"Raoul" ...	PIGSTICKING IN BENGAL.	—

On page 239, under *Lion*, enter :

23 a.	Lion ...	THE KATHIAWAR LION. By Lt.-Col. A. A. Fenton. Vol. 20, No. 3, pp. 737 to 752. This deals with hunting the Lion in Gir Forest.	1911

Opposite item 23, enter year of publication 1909

On page 239, under *Lion*, strike out the line: (*also see Vol.* 48. 493–515, 1909)

On page 239, enter :—

23 b.	Lion ...	THE GIR FOREST AND ITS LIONS. By M. A. Wynter-Blyth.	1949
		Part I. With a Map. A full and informative description of the area. Vol. 48, pp. 493-514.	1949

Part II. By M. A. Wynter-Blyth and Kumar Shree Dharmakumarsinhji, Vol. 49, No. 3, pp. 456-470. The Test Count—The Census—Conclusions and Recommendations—History of Junagadh Lions 1886 to 1936. 1950

Part III. By K. S. Dharmakumarsinhji and M. A. Wynter-Blyth, M.A. Vol. 49, No. 4, pp. 685–694. 1951

Vegetation—Habits and measurements.

On page 237, opposite item 14, last line, enter year of publication. 1925

WANTED. Year of publication of items: 58 b, 89, 90, 139, 209 and of 'Pigsticking in Bengal' by 'Raoul'.

Members able to supply the above wants, or to make any suggestions for further additions or amendments are asked to send these to the Honorary Secretary.

BANGALORE, R. W. BURTON,
15*th June*, 1951. *Lt.-Col.* I.A. (Retd.)

7. CROWS HAWKING FISH ON WING

It was early morning of December 31, 1945 and I was walking along a high bank of the tank at Unjha (a big town on B.B. &. C.I. Railway, 54 miles north of Ahmedabad), when my attention was attracted by a number of herons and egrets flying over the calm water of the tank. When crossing over from one side to another, the birds flew very low, sometimes actually skimming the surface and at suitable places, they would dip their long bills with part of neck into the water and pick up fish which they swallowed upon reaching the bank. What was more remarkable was the presence of some House Crows among them, behaving likewise. These crows, about eight in numebr, were flying in company of the herons and egrets, though not so near the surface, and imitating their companions by actually diving for fish! They did not penetrate the water very deep but just broke the surface, and were not always successful in catching fish. But whenever they were able to strike a catch, the crows left the herons and egrets and immediately flew to the nearest bank and devoured the fish piecemeal. After consuming the fish, they returned to join the herons in fishing. As the crows are constitutionally unfit for aquatic life, their diving stunts appeared ludicrous. They looked particularly foolish when a pariah kite—one of several hovering about—pursued an unlucky crow with a fish in its bill and snatched away the tasty morsel. This game went on for quite a time till the sun rose and the tank began to be crowded with cattle and human beings, when the herons and egrets retired to the shelter of neighbouring trees. The crows too, in the absence of their companions, lost interest in fishing and flew off elsewhere.

SANATORIUM, SHAHIBAG,
AHMEDABAD,
9th *May*, 1951.

HARINARAYAN G. ACHARYA

8. MATING OF THE HOUSE CROW (*CORVUS SPLENDENS SPLENDENS* VIEILLOT)

I am to record the following two experiences which, I hope, will further help to clear the mystery that still seems to surround the mating habits of the Indian House Crow in some quarters.

In May, 1946, having been bitten by a mad dog, I had to attend the Civil Hospital daily for a fortnight for taking a course of anti-rabic treatment. This hospital is situated in the heart of the city and is much overcrowded at all hours. On the 17th of the month at 12 noon, after taking the injection I was leaving the hospital when a pair of House Crows flew down from an adjacent tree, apparently quarrelling, and settled on the ground in the middle of the main gate and exactly in front of my bicycle. To avoid injuring the birds, I instantly stopped the bicycle and without alighting, waited for the birds to fly away. Watching closely, I found that the crows were not fighting but what appeared to be a 'quarrel' was actually their way of expressing endearment and mutual love preparatory to mating, for immediately on reaching the ground, the pair started copulating. The female was sitting on the ground and the male bird was treading her in the normal manner of birds. The pair were so engrossed that the continuous passage of human beings through the gate and the noise and bustle around them did not seem to disturb them.

The birds were hardly a couple of feet from my bicycle and I could observe the whole function minutely from start to finish. During the act the male was cawing somewhat loudly but the female only uttered a sweet and low cooing expressive of her satisfaction. The act continued for some seconds, when the male bird got off the back of his mate and both flew away together into a tree and I proceeded on my way. About a week after the above incident I got another opportunity to observe the mating of House Crows. On 26th May 1946 I was returning home after getting my regular dose of injection at the hospital. Outside the city limits, on the road leading to the Cantonment, I heard a loud cawing from a roadside tree. I got off my bicycle to investigate. The female crow was calling softly from a branch in a nim tree, and the male bird was loudly replying from a superior branch in the same tree about ten feet away. This continued for two or three minutes, when the male bird flew down from the upper branch, mounted the female bird and copulated with her. In this case also there was no haste during the act and both the birds were silent except for a soft cooing by the female bird as before. The act must have lasted a few seconds, when the pair separated and flew away to different trees. The time of day was 1 p.m.

SANATORIUM, SHAHIBAG,
AHMEDABAD,
9th *May*, 1951.

HARINARAYAN G. ACHARYA

9. LARGE GREY BABBLER ATTACKING METAL HUB-CAP OF CAR

In the third week of March, I was staying with friends at 8, King George's Avenue, New Delhi. One morning, as I was walking about in the garden, I heard strange sounds from the direction of my car which was standing under a tree on the lawn. I found a Large Grey Babbler behaving exactly as described by Mr. H. G. Alexander on p. 550 of the Society's *Journal* for December 1950. I am sure Mr. Alexander will be interested to read of this 'Parallel Experience' of an old friend.

'SOUTHWOOD'
MUSSOORIE U.P.
22nd April, 1951.

HAMID A. ALI

10. BIRDS ATTACKING THEIR REFLECTIONS

I am inclined to disagree with Mr. H. G. Alexander in his opinion that the babbler which attacked the hub-cap of his car did so for auditory rather than for visual reasons (p. 550 of the *Journal*, Vol. 49, No. 3).

I once had a similar experience with a House Sparrow (*Passer domesticus*) and a small shaving mirror. The latter, when pecked, made only a dull rattling sound, but my sparrow waged war on it for some hours with an appearance of extreme annoyance which I attributed to the clear reflection of himself which he had in front of him.

This happened in Mominabad in the north-western part of Hyderabad State, while I was spending a couple of days in a dak bungalow. The sparrow, a cock bird, arrived in my bathroom shortly after I had unpacked my kit and at once began to attack my shaving mirror, chirruping hard. He kept this up for the rest of that day and for the whole of the next morning, until I packed up once more to leave. He was absent during the day for only very short intervals. I had ample time to spare and so sat for some hours watching him, and when I realised how engrossed he was in his campaign, I drew a chair close up to the scene of operations and in a very short time, by making my hand the only convenient place on which to stand in front of the mirror, I had him perching on my finger and continuing his attacks from there.

That he was really annoyed with his imagined rival, I am quite certain, for he permitted me to raise my hand some distance in the air so long as I kept the mirror near with the other hand. As soon as I lifted him too far from the mirror he would hop off my finger and carry on the fight from some other vantage point. He even ended up by pecking fiercely at my knuckles when he could not get at the mirror, and I am convinced that had he been merely fascinated by the sound of his beak against the glass he would not have been so fearless of my movements. As it was, I think that he was indeed so concerned with the rival in the mirror on whom he could make no impression, that he failed to react in the normal way to the presence of a by no means motionless human hand.

HONGKONG HOUSE,
CALCUTTA,
28th April, 1951.

P. F. CUMBERLEGE

11. STRANGE BEHAVIOUR OF THE JUNGLE BABBLER (*TURDOIDES TERRICOLOR*)

One of our neighbours owns a Hillman car, which he occasionally parks for the night in the compound in front of our house. The wheels of this car have shining convex nickel-plated hub-caps with a smooth surface. On Sunday, the 6th May 1951, at about 7 a.m., I was idly watching three Jungle Babblers (*Turdoides terricolor*) feeding on the ground in front of my house. When they reached the front off-side wheel, they suddenly started jumping up and pecking vigorously at their reflections in the metal hub-cap. A fourth bird joined them. The pecking was so vigorous that the loud and sharp 'thud' 'thud' of their beaks on the metal plate could easily be heard at a distance of 25 yards. Not satisfied with jumping up from the ground to peck, two of the four birds took their station on the rim of the metal cover on opposite sides and kept on drumming. This must have lasted for over a minute when, apparently disgusted by the cowardly behaviour of their opponents within, the four babblers in a body moved to the rear off-side wheel and repeated the performance with very little variation. This time only the original three birds took part in the onslaught; the fourth bird, after a couple of half-hearted pecks, lost interest in the fray and moved away in search of better sport. The three musketeers, when they found that even here there was no response to their challenge, again returned to the front off-side wheel and renewed their attacks once more. After a time, they went round the front end of the car to its other side and started pecking on the metal cover of the front right-side wheel. After vigorous pecking for a minute or so, when they found that their attempt to provoke the birds there also failed, they got under the car and crossed over to the other side and started pecking at the cap on the front off-side wheel. Meeting with continued lack of response the three babblers quieted down and without further efforts flew away to fresh pastures.

On 8th May, 1951 I again—this time in company of my family and several children from the neighbourhood—witnessed the same performance repeated. The time was 1 p.m.; the number of performers 2 to 4 Jungle Babblers. The attack was repeated at intervals of a few minutes: this time only on the front and back hub-caps on the off-side of the car which was in shade, the birds moving in and out of the adjoining shrubbery for repeated attacks. They were still at it when I left the place at 1.45 p.m.

The metal covers are 12″ across and their lower edge comes to within about 7″ of the ground level. On examination I found that the figures of the attacking birds reflected in the metal cover, though much reduced, were in no way distorted, for squatting at a distance of a couple of feet from the wheel, I found my own reflection quite proportionate.

Our house is situated in a big compound with several large trees and a small garden. There are about 23 Jungle Babblers living in this compound. The birds are sometimes found moving together, but usually they live upto their name of 'Sāt Bhāi': 'Sāt', here meaning anything from five to nine. They are absolutely fearless and boldly enter our house whenever they wish to. On the verandah, we have a wide sofa-like wooden swing, fitted with a looking glass in the middle of the back-rest. This has always proved a red-rag to the Jungle Babblers. Every day and at all hours, a party of these birds comes to the mirror and whiles away considerable time in pecking vigorously on the glass surface at their own reflections in it. When the attackers are more than one, they, instead of jumping up from the floor of the swing and pecking on the mirror, actually fly to the sides of the mirror and holding on to the rim with their feet, peck their heads away. Getting tired of the unbearable mixed noise of their vocal clamour and hammering on the glass, my wife often covers the mirror over with a thick blanket or a folded saree. The birds, however, do not find the eight folds of a saree a great deterrent and undaunted they boldly go under the folds of the cloth and start jumping up and pecking at the mirror behind the curtain. The undulating swift movement of the folds of the saree covering the mirror, gives the illusion of a writhing snake attempting to free himself of the covering.

We are living in this compound for the last thirteen years and during that period, the Jungle Babblers have been our constant companions and they breed here. I cannot say whether they are the same birds, but there is no great variation in their number. I have never seen either the Large Grey Babbler (*Argya malcolmi*) or the Common or Striated Bush-Babbler (*Argya caudata*) in our compound, though, several years back, two pairs of the Rufous-bellied or Mount Abu Babbler (*Dumetia hyperythra albogularis*) had built their nests close to the wall of our house—one, on ground, in depression at foot of a cactus plant, 4 eggs, 11-6-1938; the other in a Kund (*Jasminum arborescens*) bush about 2 ft. from ground, 3 eggs, 25-8-1938.

The Jungle Babblers are extremely noisy and their boldness is remarkable. For the past several years, our household has been lorded over by a family of pet cats. By nature very quiet and always well fed, some of these cats sometimes do hunt birds, if the effort is not too great. Their usual prey has been squirrels, pigeons, doves, an occasional myna and once a Red-vented Bulbul who had become so bold as to attempt to pick up food from the cat's table. Even the nimble-witted Magpie Robin has not been able to escape the attention of a wary cat. But, strange to say, the cats have never preyed on the Jungle Babblers. Usually the cats' food-plates are placed on the verandah in front of the kitchen and a variety of birds come to feed from it. But they hardly dare to fly down to the plates if any of the cats is about. Not so the Jungle Babblers. They not only come to the plates but actually 'mob' the cat, who enjoying her siesta, finds the tremendous babbling too much for her sensitive nerves and moves away elsewhere, leaving the field to the babblers. The cats, some of them at least, always dare the peacocks and peahens that come every morning and evening to our house to be fed by my wife, but until now no cat has ever caught any of the Jungle Babblers or has even molested or pursued them. Perhaps the cat, being an epicurean in her tastes, does not fancy the Jungle Babbler. Who can say!

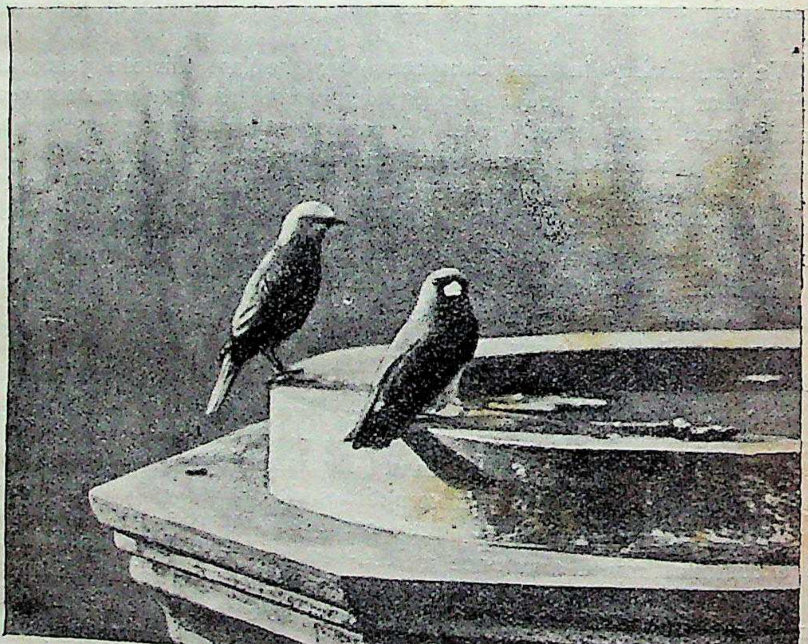
SANATORIUM, SHAHIBAG,
AHMEDABAD,
8th May, 1951.

HARINARAYAN G. ACHARYA

12. THE ASHY SWALLOW-SHRIKE (*ARTAMUS FUSCUS* VIEILLOT) AT A BIRD BATH

(*With a photo*)

Although I have no evidence of this Swallow-Shrike actually settling on the ground I have proof of the nearest thing to it. Some years ago while staying with my friend, the late H. V. O'Donel, on the Huldibari Tea Estate in the Duars, the bird bath was visited by a Grey-headed Myna [*Sturnus m. malabaricus* (Gmelin)]. The bath was in the garden quite close to the house. Immediately afterwards an Ashy Swallow-Shrike settled on the plinth quite close to the myna. As my friend had a permanent hide near the bird bath this photograph was easily obtained. I consider this observation of sufficient interest for record.



KENILWORTH,
COONOOR,
NILGIRIS,
14th April, 1951.

C. M. INGLIS,
F.Z.S., C.M.B.O.U.

13. OCCURRENCE OF HODGSON'S PIPIT (*ANTHUS ROSEATUS*) IN SAURASHTRA

It was at the end of March and beginning of April that I witnessed the return migration of different kinds of wagtails on the Gaurishanker lake, Bhavnagar. There were a multitude of them, but what attracted my attention was a pipit, much like our tree-pipit, walking by itself on the green grass close to the water's edge. It was brighter but appeared much the type which Horace Alexander had recently pointed out to me in Delhi as Hodgson's Pipit. That bird I never saw again, but in trying to rediscover it I came across a number of others in fresh plumage—vinous pink or warm buffy breasts, heavy striations on the upper parts and conspicuous black streaks on the flanks—answering to what Alexander had described as their breeding plumage. There were also a few without the bright breasts. But as I had never met the species here before, specimen collecting was the only way of confirming my identification. It was more than difficult to approach the birds as they took wing just out of range; and as soon as I flushed a bird it chased another and the pair settled far away, always keeping to the waterside. I finally managed to collect three of which two were sent to the Bombay Natural History Society for verification. Sálim Ali informs me that he has never seen this species from further south than Gwalior so this would seem to be a new record.

DIL BAHAR,
BHAVNAGAR, K. S. DHARMAKUMARSINHJI
1st May, 1951.

14. DISTRIBUTION OF THE BLUE-BEARDED BEE-EATER [*NYCTIORNIS ATHERTONI* (JARDINE & SELBY)]

With reference to 'Notes on some Asiatic Meropidae' by Daniel Marien in Vol. 49. No. 2 (p. 162) I have to point out that Mr. E. H. N. Lowther in his book 'A Bird Photographer in India' reports on page 34 the occurrence of the Blue-bearded Bee-eater at Topchanchi Reservoir in the Manbhum District of Chota Nagpur.

I have also come across another reported occurrence of the species in Chota Nagpur, where according to Mr. Marien the bird has not been seen. A pair was seen on 5-11-44 by Captain R. H. Baillie at Hazaribagh, and was reported by him in the *Journal of the Bengal Natural History Society* (Vol. XX, No. 4, April, 1946). Dr. S. C. Law commenting on Captain Baillie's recordings in a series of critical notes in subsequent issues of the same journal referred to his own experience of the bird-life of Hazaribagh and said that the Blue-bearded Bee-eater was rare in the District and its status and distribution uncertain.

I have never seen the Blue-bearded Bee-eater myself in Chota Nagpur proper, but I have seen it a little to the north-east at Gidhaur in Monghyr District. According to Mr. Marien himself the bird was collected in

Surguja, at Ramanujganj, which village is separated from the Palamau District of Chota Nagpur only by a narrow stream.

JAMAL ARA

c/o Sami Ahmad, Esq.,
Forest Rest House,
Hinoo, P.O., Ranchi,
5th March, 1951.

15. 'BIRDS OF THE LONDA NEIGHBOURHOOD'.— A CORRECTION

In the *Journal* Vol. 45, p. 236 while referring to the erroneous records of the occurrence of *Gyps fulvus* around Bombay we doubted Koelz's inclusion of this species in the birds of the Londa Neighbourhood (*J.B.N.H.S.* Vol. XLIII, p. 28) where he claimed to have obtained a specimen and seen a congregation of 50 individuals. The last remark in particular prompted us to write for verification to the American Museum of Natural History where the collections are now housed, and we understand that the specimen is actually *Gyps indicus*.

114, Apollo Street,
Bombay,
25th May, 1951.

SÁLIM ALI
HUMAYUN ABDULALI

16. THE POSITION OF PLOVERS' EGGS IN NESTS

On Sunday the 13th May 1951 I visited the north end of Walwan Lake, Lonavla (Poona District) to examine a nest of the Little Ringed Plover (*Charadrius dubius jerdoni*) which Br. Navarro of St. Xavier's High School, Bombay, had discovered. The three eggs were laid in a slight hollow in the coarse sand—there being no appreciable nest—*with the points downwards*. The circular broad ends of the eggs alone were visible from above in the form of tiny domes.

K. S. Dharmakumarsinhji of Bhavanagar, to whom I mentioned this states that he has seen nests of both the Kentish Plover and the Little Ringed Plover with eggs resting in a similar vertical position.

This does not appear to have been recorded hitherto for Indian birds, though the 'Handbook of British Birds', Vol. IV, p. 361, says of the Kentish Plover (*Leucopolius a. alexandrinus*)—'Nest: Sometimes a mere hole in sand in which eggs are usually buried, points downward.'

c/o Faiz & Co.
75, Abdul Rehman Street,
Bombay, *19th May* 1951.

HUMAYUN ABDULALI

17. BIRD MIGRATION IN INDIA

Since publishing the records in Vol. 47, pp. 690–699 and Vol. 48, p. 586 the following information has been obtained concerning two further recoveries of ringed birds from the Bird Banding Bureau in Moscow through the good offices of the Embassy of India in Moscow—

No. of ring	Date	Name of bird	Place where ringed	Remarks (adult or young)	Name of ringer	Date of recovery	Reported by	Place where recovered	Remarks
141339 D (MOSKWA)	21–7–1949	Pintail (*Anas acuta*)	Novosibirsk oblast Lake Chany, 54° 35′N 77° 40′E	female	Central Bird Banding Bureau, Moscow	27–12–1950	N. O. Blanchette of Aligarh	Putna in Etah District U.P.	
75550 D (MOSKWA)	8–8–1939	Mallard (*Anas platyrhynchos*)	Astrakhan Preserve (Volga Delta)	male	Central Bird Banding Bureau, Moscow	14–1–1942	Major E. J. Van Ingen	Faidah, about 30 miles north of Mosul, Iraq	

EDITORS.

114, Apollo Street, Fort,
Bombay, 2nd May 1951.

18. 'NOTES ON SOME ASIATIC STURNIDAE (BIRDS)'—A COMMENT

In his paper in the December issue of the Bombay Natural History Society's *Journal* (**49**, 1950, pp. 481 and 484), Mr. Daniel Marien has made some comments about two new races of Indian starlings proposed by me (*Postilla*, No. 1, 1950). In the case of the first form, *Sturnus contra sordidus*, Mr. Marien has quoted part of my description and the range as given, and then goes on to add that a single specimen in the Rothschild Collection in New York shows none of the stated characters of this race.

In the case of the second form, *Acridotheres cristatellus fumidus*, Mr. Marien has quoted part of my description and the range which is north Cachar and Lakhimpur and the Mishmi Hills in Assam. In this case Mr. Marien has looked at four worn males from the Khasia Hills and finds none of the characters of *fumidus* in these birds.

In view of the fact that Mr. Marien has looked at one specimen of *Sturnus contra* from the range of *sordidus* and four specimens of *Acridotheres cristatellus fumidus* from the Khasia Hills which is *not* in the range as given by me—the Khasia Hills being west of Cachar—it becomes difficult to take the rest of his critical remarks too seriously. Since reading Mr. Marien's paper I have checked my original conclusions by sending my types and accompanying series of each of these forms to another museum requesting independent confirmation of my findings. I have been pleased that the colleague who examined this material and who is familiar with Asian birds, has agreed with me and has upheld the characters of my races as published. I should point out, however, that on p. 4 of my description of *fumidus*, where it has been compared with *grandis*, the printed word should be 'lighter' rather than 'dark'. But this point is immaterial in the present discussion.

The factor which at once appeared surprising to me in reading Mr. Marien's paper is that the American Museum of Natural History in New York City, where the collections are housed of which this gentleman writes, and the Peabody Museum of Yale University where the material to which he refers is located, are only seventy-five miles apart. It is extremely easy to communicate by a variety of means between these museums. In fact I myself am frequently in the New York institution working on ornithological research, and in the seventeen years that I have been associated with that institution as a co-worker in ornithology I have borrowed material freely at all times and always been accorded numerous gracious courtesies. From a physical point of view therefore there should be no impediment to ready exchanges. From a scientific point of view it is not thorough or systematic to leave such ravelled edges to a review of species. Occasionally a museum may be encountered whose philosophy may include the feeling that 'a subspecies is not a subspecies if it is not included in our collection,' but I am sure from my experiences in New York that this can hardly be the philosophy of my colleagues there nor could Mr. Marien have been so indoctrinated. It is far too unscientific. Nor can such a lack of liaison do anything but cast doubt upon the professional capabilities of the museum workers concerned, and thus tend indirectly to discredit the profession as a whole.

PEABODY MUSEUM OF NATURAL HISTORY,
YALE UNIVERSITY, S. DILLON RIPLEY
NEW HAVEN, CONNECTICUT, U.S.A.
5th *May*, 1951.

19. DURATION OF SONG IN SOME COMMON BIRDS

(*With five graphs*)

During April, 1950, I was at Daltonganj, the headquarters of the District of Palamau in Bihar. The residence I was occupying had several young mango trees in its compound, but on the north a large orchard adjoined. This orchard was in a sadly neglected condition, but from my point of view was ideal. Apart from the fruit trees i.e. mango and guava, this orchard had several other species, mainly *Butea frondosa, Broussonetia flabellifera, Cassia fistula, Poinciana regia, Bombax malabaricum, Azadirachta indica,* and *Tamarindus indicus*. There was a dense undergrowth of lantana and coarse spear grass (*Imperata arudinacea?*). Twenty-seven species of birds were seen by me in this area during a stay of approximately 4½ months, out of which eight species had started nesting by the middle of April when I left. The territories of the Crimson-breasted Barbet [*Megalaima haemacephala* (Muller)] and the Magpie-Robin (*Copsychus saularis* Linn.) were very well defined and comparatively narrow, and were incorporated by me in a single field sketch. While studying the territories of these birds, I was struck by the remarkable periodicity their songs seemed to have, and I decided to time them over a number of days to check up this impression. Observations started at 5 a.m. and were continued till after sunset over a period of 10 days. Neither of these species commenced calling before 5 a.m. and so this hour was selected as a convenient starting point for the observations. No observations could be made after dark. By confining my observations to the territories of these birds I ensured that the singing time of the same individual was noted over the entire period. At the same time I made observations on the Papiha or Brain-fever Bird (*Hierococcyx varius* Vahl.), and the Koel (*Eudynamis scolopaceus* Linn.) as well. But as these birds have apparently no fixed territories I am unable to guarantee that the same individual was concerned throughout the period. All the same it must be noted that only a single pair of each species had been observed in the area over a long period of time, so it would not be unreasonable to presume that the individual birds observed during the entire period of 10 days were the same. Observations on the Yellow-cheeked Tit (*Machlolophus xanthogenys* Vigors) made at Ranchi in the first week of May 1950, were confined to the territory of the nesting bird.

The duration of each burst of song was timed with a Rolex Oyster wrist watch fitted with a centre second hand and noted against the hour at which the song was heard. On the completion of the observations, the total duration of song over each clock-hour was averaged and plotted against the middle of that clock-hour. It will therefore be noticed that all the curves began from 5.30 a.m., but

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the inference should not be drawn that all these birds started calling precisely at that time. This time is just the middle of the clock-hour from 5 a.m. to 6 a.m. and the time against it expresses the total duration of the call during this particular clock-hour. The same remark applies to all the points of the curve. The results may be summed up as under:—

Magpie Robin, Male.—A peak early in the morning, followed by a very steep descent to the middle of the day. A minor peak again late in the afternoon.

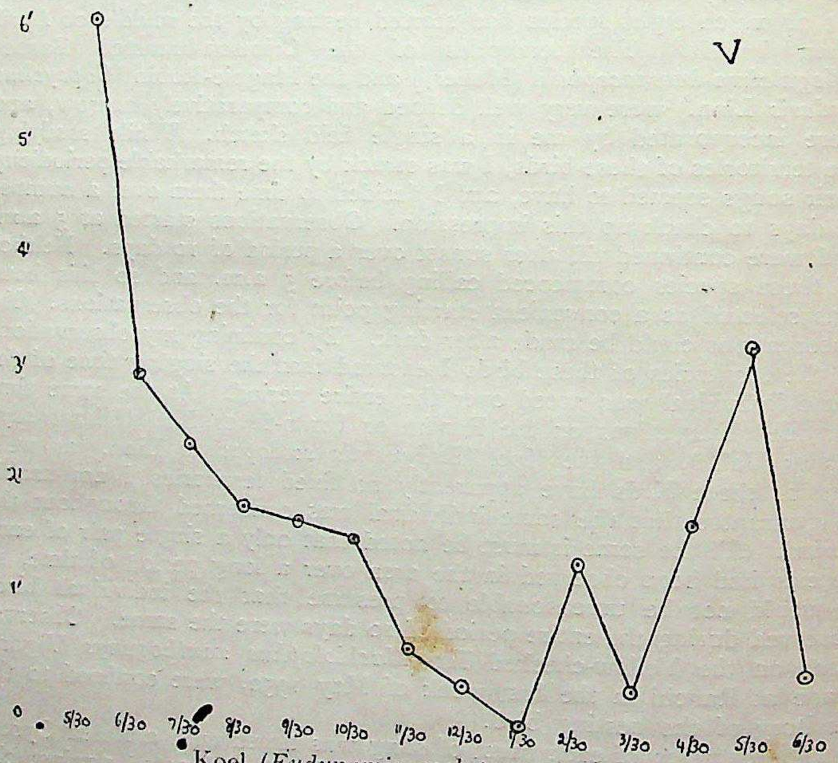
Crimson-breasted Barbet.—A peak in the early morning followed by a minimum between 7 and 8 a.m. Then follow peaks of increasing amplitude culminating in another maximum late in the afternoon.

Yellow-cheeked Tit.—Two pronounced maxima early morning and late afternoon, with a subsidiary peak late in the morning.

Brain-fever Bird (Papiha).—A maximum between 6 and 7 a.m. followed by peaks of decreasing amplitude, culminating in another maximum in the evening.

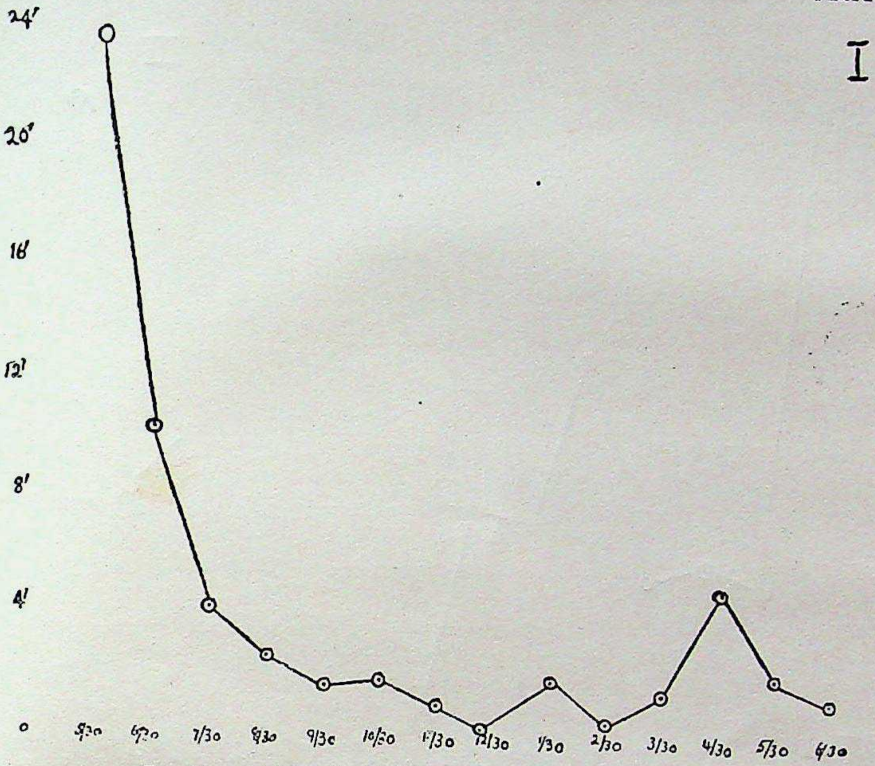
Koel.—A very pronounced maximum early in the morning followed by a steep fall; a subsidiary peak early in the afternoon, culminating in another maximum in the evening.

V

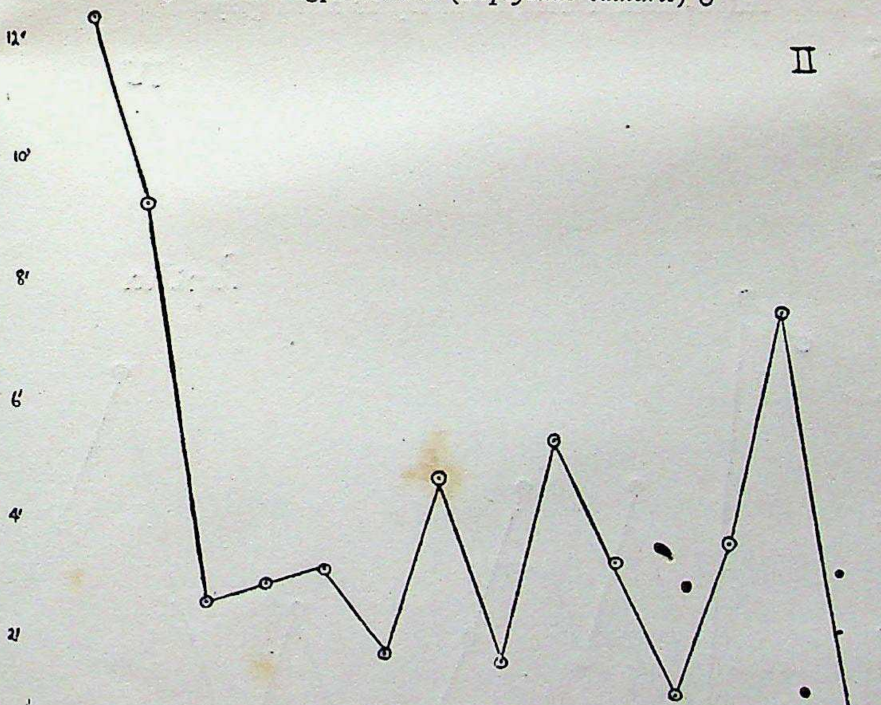


Koel (*Eudynamis scolopaceus*) ♂

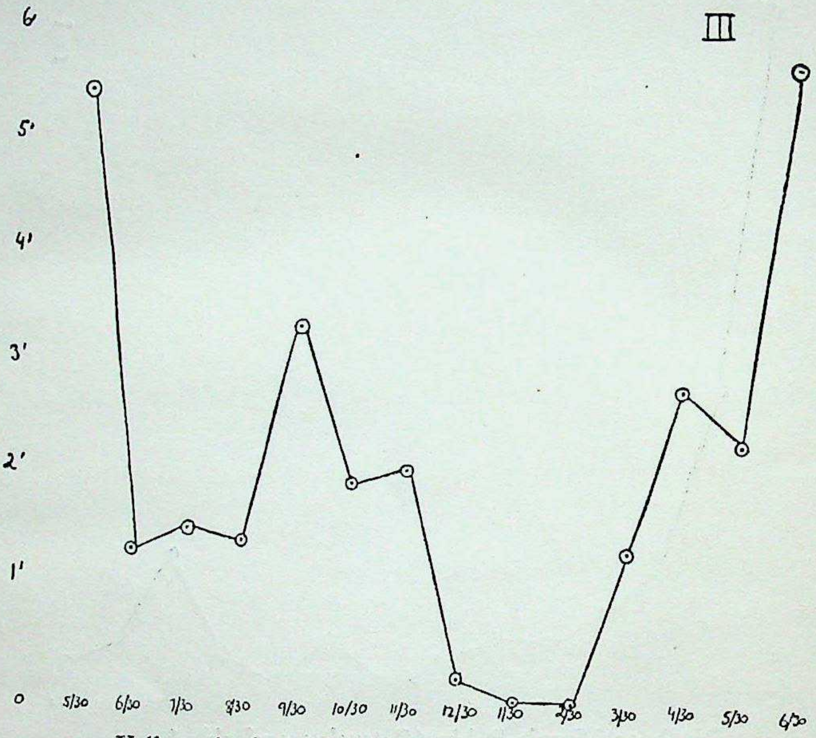
The weather throughout was warm with one or two cloudy days. Dust storms were fairly common throughout the interval, generally in the afternoon. Average time of sunrise was 5·50 a.m. and sun-



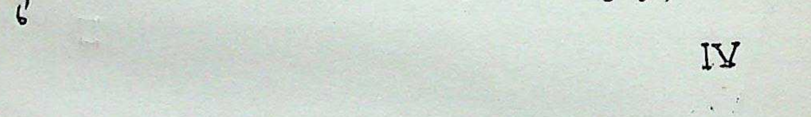
Dyalh or Magpie-Robin (*Copsychus saularis*) ♂



Crimson-breasted Barbet (*Megalaima haemacephala*)



Yellow-cheeked Tit (*Machlolophus xanthogenys*)



Papiha or Brain-fever Bird (*Hierococcyx varius*) set 6.15 p.m. No attempt was made to co-ordinate the duration of calls with the type of weather prevailing. It is hoped to make this the subject of a future study.

I am not aware if such studies have been made on Indian birds before. No such information is available from the literature in my possession. I shall be much obliged if any reader will put me in touch with earlier observations of this nature.

The total output of song in a day of approximately 12 hours and 25 minutes for each of the species under observation was as follows:—

1. Magpie Robin (male)—53.6 minutes.
2. Crimson-breasted Barbet—58.5 minutes.
3. Yellow-cheeked Tit—28.7 minutes.
4. Brain-fever Bird (Papiha)—21.8 minutes.
5. Koel (male)—24.5 minutes.

SUMMARY

During April and May, 1950, observations were made on the duration in minutes of songs of 5 different birds at hourly intervals. The results show that peaks occur in the morning and evening with a period of comparative silence in the middle of the day.

JAMAL ARA

20. ANGLING FOR CROCODILES WITH HOOK AND LINE IN KRISHNARAJASAGAR RESERVOIR

It is common practice to angle for fish; but to angle for and land alive a crocodile is novel and very exciting.

The author started with the idea of devising a method to catch crocodiles on hooks. No data was available except local stories of live dogs and cats being used as baits with country-made hooks tied around their necks and left tethered on the river bank in likely spots.

The method of catching fish on night-lines with bait could be suitably modified for the purpose in question by using bait other than live cats or dogs.

Hook.—The largest size of Norwegian fish-hooks i.e. No. 1 size 3 in. long by $\frac{1}{8}$ in. thick were procured. As double hooks are not available, two such hooks were jointed shank to shank so as to have the prongs facing out.

Line.—Strong coir rope, 100 ft. long, $\frac{1}{2}$ in. in diameter and hand-twisted was used.

Bait.—At first chunks of butchers' meat were used. But with the heavy hooks and stout ropes the whole bait sank to the bottom and no results were achieved over half a dozen trials. Since while lining for fish the baits whether alive or otherwise would float on water, it was thought better to give a floating bait to the crocodile. An empty sealed tin was used as buoy, but 3 or 4 trials resulted in failure.

Now it was decided to change the bait; as such, sheeps' lungs was chosen this time to replace meat. Sheeps' lungs besides being cheap are capable by themselves of remaining afloat even with the heavy hook imbedded inside.

On the first attempt when the baited hook was left overnight and examined the next morning, the rope (minus bait and hook) was found floating in the water, the cut-end of the rope clearly showing that it had been chewed up between the jaws of a crocodile. This kindled hopes of eventual success. To prevent the hook being torn away a one yard length of the line between hook and coir rope was made up of about a dozen thin but highly twisted cotton rope-strands loosely put together. As each strand was only ¼ in. in diameter, it was expected that the strands would slip between the 'V' shaped teeth of the crocodile and thus escape being bitten through.

Attempts were renewed and quickly met with success as narrated below.

9-4-50.—At 7 p.m. the baited hook was taken out and left floating about 20 ft. from shore where the water depth was about 10 ft. The other end of the rope was strongly secured to a steel crow-bar driven deep into the ground.

10-4-50.—At 6 a.m. it was noticed that the bait was no longer floating. A slight exploratory pull on the rope resulted in violent disturbance in the water and the crocodile made himself visible by lashing out his tail. When it was made certain that the reptile was properly hooked, the problem was to secure him alive. The alternative was to get him shot.

A second rope was procured and placed in a loose-hitch on the first rope. By having two men pull on this rope, the crocodile was, with great difficulty slowly hauled ashore and held between the two ropes.

A running noose was, with great difficulty, placed over the snapping jaws; and another secured the lashing tail. The crocodile was now hitched up between two stout and long bamboos. It took 8 men to carry him over to the dam-side where he was left in a shallow fountain sufficiently well secured. It measured 10 ft. 9 in. The hook was deeply imbedded and could not be safely dislodged.

11-4-50.—The next morning the crocodile was found dead, obviously due to hook-injuries as the hauling-in caused the hooks to tear deep in the guts. This was later confirmed.

Post-Mortem.—The hook was found deep in the guts in the stomach-region and large tears in the abdominal wall were found.

Examination of the guts disclosed some remarkable contents. (1) over a dozen pieces of bone 3-4 in. long and 1-1½ in. in diameter. The bones were broken up, hence it was not possible to make out whether they were human or animal in origin. (2) about a dozen pebbles ½-1 in. in size and worn smooth. (3) human-body remains:—a human left hand cut off at the wrist and a human left foot cut at the ankle. These were fairly fresh except that the colour was very pale. Finger and toe-nails were nearly intact. Loosely hanging nerves and muscles indicated that swallowing had been fairly recent.

Conclusion.—The above method having met with success deserves to be tried out regularly and further developed. The elimination of these dangerous reptiles is very necessary for the safety of the villagers and their cattle not to speak of the thousands of fish that must be destroyed by the large number of reptiles that inhabit the reservoir.

DEPARTMENT OF A.H. SERVICES,
BANGALORE.
15th April, 1951

D. R. KRISHNAMURTHY
Fishery Research Assistant

21. A CURIOUS DEATH OF A SNAKE

On 29-4-1947, the senior author found a dead *Tropidonotus piscator* (Schn.)—popularly known in Oriya as 'Pani Dhanda'—in his pond in the heart of Cuttack. On examining for the cause of death it was found that the snake had in its mouth cavity an entire fish *Callichorous pabda* (Day). The fish specimen measured 8.11 inches in length and 3.7 inches in its greatest circumference. The snake was an adult measuring 3 feet 1.6 inches in total length. The species is common in our ponds and subsists on fishes. It is probable that the pectoral spines of the fish stuck in the snake's mouth and so it could not be swallowed, neither could it be rejected owing to the nature of curved teeth characteristic of the Ophidians.

We are thankful to Sri S. R. Upadhyay of our laboratory for the determination of the fish and to Prof. D. Mukerji of the Department of Zoology, University College of Science, Calcutta University for kindly going through the manuscript.

Department of Zoology,
Ravenshaw College,
Cuttack

B. K. BEHURA
M. A. JOHN

22. EGG-LAYING BY A PYTHON IN CAPTIVITY

Your *Journal*, December 1947, published a note of mine on the breeding of the Indian Python (*Python molurus*).

Details up to date, 21st May 1951 are as follows:—

On 4 April 1938 this python, a pet of mine, mated with a small male, and laid eggs on 4 June 1938. After 4 April 1938 no male pet python has ever been near the cage.

Date	Number of eggs laid	Period of captivity
4 June 1938	(2 months after mating)	
9 June 1947	16	9 years
6 June 1948	20	10 ,,
5 June 1949	16	11 ,,
and 21 May 1951	12	13 ,,

These last eggs are: 7 of normal size 8½ inches round the centre.
10½ ,, ,, the ends.
5 small, the size of a goose egg.

Loyola College,
Madras,
21st *May*, 1951

C. LEIGH, S.J.

23. A RECORD OF THE COMMON MEMBRACID, *OTINOTUS ONERATUS* WALK. (HOMOPTERA: RHYNCHOTA) FROM THE CITY OF PATNA (BIHAR)

This is an extension of the distribution of the common membracid *Otinotus oneratus* Walk, in Bihar and an addition to the list of its hostplants. It was only reported from Ranchi in Bihar (Distant, W. L. 1907. 'Fauna of British India. Rhynchota', 4: 40-41).

Adults and nymphs of *O. oneratus* were collected by us in the garden of the Science College, Patna on 28-8-1950 from the following plants:—

1.	*Carissa carandus* Linn.	Hindi:	Koiraundo
2.	*Lagerstroemia indica* Linn.	,,	Swani
3.	*Polyalthia longifolia* B. & H.	,,	Asoka

In all cases membracids were attended by the common black ant *Camponotus compressus* Fabr.

We are thankful to Sri Jangilal Srivastav of the Department of Botany, Science College, Patna for kindly identifying the plants.

Department of Zoology,
Ravenshaw College,
Cuttack.
Department of Zoology,
Science College, Patna.

BASANTA KUMAR BEHURA
VISWANATH SINHA

24. GLEANINGS

Quenching thirst with raw fish.

'The old natives know well the device which many shipwrecked men hit upon during the war—chewing thirst-quenching moisture out of raw fish. One can also press the juices out by twisting pieces of fish in a cloth or, if the fish is large, it is a fairly simple matter to cut holes in its side, which soon become filled with ooze from the fish's lymphatic glands. It does not taste good if one has anything better to drink, but the percentage of salt is so low that one's thirst is quenched'.

Flying Cuttlefish.

During the course of the voyage several cuttlefish were found on the deck [of the raft] and even on the top of the roof of palm leaves. It was some time before the reason was discovered.

'One sunny morning we all saw a glittering shoal of something which shot up out of the water and flew through the air like large rain-drops, while the sea boiled with pursuing dolphins. At first we took it for a shoal of flying fish, for we had already had three different kinds of these on board. But when they came near, and some of them sailed over the raft at a height of four or five feet, one ran straight into Bengt's chest and fell slap on the deck. It was a small squid. Our astonishment was great. When we put it into a sailcloth bucket it kept on taking off and shooting up to the surface, but it did not develop speed enough in the small bucket to get more than half out of the water. It is a known fact that the squid ordinarily swims on the principle of the rocket-propelled aircraft. It pumps sea water with great force through a closed tube along the side of the body, and can thus shoot backwards in jerks at a high speed; and with all its tentacles hanging behind it in a cluster over its head, it becomes streamlined like a fish. It has on its side two round fleshy folds of skin which are ordinarily used for steering and quiet swimming in the water. But it was thus shown that defenceless young squids, which are a favourite food of many large fish, can escape their pursuers by taking to the air in the same way as flying fish. They had made the principle of the rocket aircraft a reality long before human genius hit upon the idea. They pump sea water through themselves till they get up a terrific speed, and then they steer up at an angle from the surface by unfolding the pieces of skin like wings. Like the flying fish, they make a glider flight over the waves for as far as their speed can carry them. After that, when we had to begin to pay attention, we often saw them sailing along for fifty to sixty yards, singly and in twos and threes. The fact that cuttlefish can 'glide' has been a novelty to all the zoologists we have met'.

Sharks and Shark-fishing.

'Generally it is smell more than sight which excites sharks' voracity. We have sat with our legs in the water to test them, and they have swum towards us till they were two or three feet away, only quietly to turn their tails towards us again. But if the water was in the least bloodstained, as it was when we had been cleaning fish, the sharks' fins came to life, and they would suddenly collect like bluebottles from a long way off. If we flung out sharks' guts, they simply went mad and dashed about in a blind frenzy. They savagely devoured the liver of their own kind, and then if we put a foot into the sea they came for it like rockets and even dug their teeth into the logs where the foot had been. There are sharks and sharks, because the shark is completely at the mercy of his own emotions'.

'The last stage in our intercourse, with sharks was that we began to pull their tails. Pulling animals' tails is held to be an inferior form of sport, but that may be because no one has tried it on a shark. For it was in truth a lively form of sport.

To get hold of a shark by the tail we first had to give it a real tit-bit. It was ready to stick its head high out of the water to get it. Usually it had its food served dangling in a bag. For if one has fed a shark directly by hand once, it is no longer amusing. If one feeds dogs or tame bears by hand they set their teeth into the meat and tear and worry until they get a bit off, or until they get the whole piece for themselves. But if one holds out a large dolphin at a safe distance from the shark's head, the shark comes up and smacks his jaws together, and without one having felt any tug half the dolphin is suddenly gone, and one is left sitting with a tail in one's hand. We had had a hard job ourselves to cut the dolphin in two with knives, but in a fraction of a second the shark, moving its triangular saw-teeth quickly sideways, had imperceptibly chewed up the backbone and everything else like a sausage machine. When the shark turned quietly to go under again, its tail flickered up above the surface and was easy to grasp. The shark's skin was just like sand-paper to hold on to, and inside the upper point of its tail there was an indentation which might have been made to allow of a good grip. If we once got a firm grasp there, there was no chance of our grip not holding. Then we had to give a jerk before the shark could collect itself, and get as much as possible of the tail pulled in tight over the logs'.

[We have here quoted at length from 'The Kon-Tiki Expedition' by Thor Heyerdhal (George Allen & Unwin Ltd., London, 1950) and cannot help mentioning that it is the most remarkable true adventure story we have read for a long time. It chronicles the voyage on a raft across the Pacific from South America to Polynesia in an attempt to prove a theory that the South Sea Islands were originally populated from South America.]

Oryxes caught alive.

The following is an extract from the *Day Bulletin* of the Arab News Agency dated 15th March 1951.—

'Recently the Emir Saud ben Juluwi was on a hunting trek in the Rab' el Khali, the great desert of Arabia, when his party came across a herd of 36 oryxes, the largest number to be seen together in many years.

With great personal bravery, the Emir's principal hunter captured several oryxes by leaping from a fast-moving car and grabbing the animals by their horns and throwing them to the ground in cow-boy fashion.

Two of the animals which the Emir's hunter captured alive, are now being kept at the Governor's palace in Hofuf.'

A Cure for Colic?

Col. O. Vickers in the *Field* of 3 February 1951 writes: 'While serving with General Younghusband's mission in Lhasa some 50 years ago I noticed many mules in the Tibetan and Bhutian caravans on the mountain tracks had only one ear. When one of my transport mules got colic and could not stand up, we gave him up for lost. A Tibetan came up to me and said, "Your mule will not die if you cut off his left ear." We performed the operation and the mule recovered.'

Gulls on Snow.

The Science Newsletter No. 6 issued by the Indian Scientific Liaison Officer in the United Kingdom, a copy of which was received by us from the Department of Scientific Research, Government of India, quotes from a report of the Arctic Health Research Centre of the U.S. Public Health Service, Point Barrow, Alaska:

'Gulls can walk indefinitely on snow at—50°C. Measurements were made of the rate of heat loss through the feet of live gulls when placed in iced water. This was so low that it suggests a rate of blood circulation at the rate of only a few cc. per hour.'

50,000 *Year old Lotus Seeds sprout now.*

Science Newsletter No. 17 quotes from the *Times* of 6th March 1951. 'Two lotus seeds estimated by officials of the National Park Service of the Department of the Interior to be 50,000 years old were to-day reported to be sprouting in a moisture chamber where they had been placed for germination tests.

These seeds, originally found in Manchuria by an archaeological expedition were presented to the Park Service last year. They had been kept in a safe until last week when it was decided to make these tests. The surfaces of the seeds were filed to make them more sensitive to water before they were placed in the chamber, where they are now showing green shoots. The age of the seeds has been estimated on the basis of the deposits in which they were found.'

CATALOGUE OF BOOKS IN THE BOMBAY NATURAL HISTORY SOCIETY'S LIBRARY

PART V—INVERTEBRATA

I—Invertebrata

I R—Invertebrata—Reference volume, not lent out.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
					Abercrombie, Alexander	(*See* Melvill, James Cosmo).
1	I	35	5	F	Agassiz, Alexander	REPORT ON THE ECHINI. Reports on the results of dredging in the Gulf of Mexico (1877-78), by the U.S. Coast Survey steamer 'Blake'—Memoirs of the Museum of comparative Zoology at Harvard College Vol. X. No. 1, 1883.
2	I	39	5	F	Agassiz, Louis	MONOGRAPHIES D'ECHINODERMES VIVANS ET FOSSILES, 1838.
3	I	6	5	D	Ashworth, J. H.	CATALOGUE OF THE CHAETOPODA IN THE BRITISH MUSEUM (NATURAL HISTORY). A. Polychaeta: Part I Arenicolidae 1912.
4	I	7	5	D	Awati, P. R. & Rai, H. S.	OSTREA CUCULLATA (The Bombay Oyster) — *The Indian Zoological* Memoirs on Indian Animal types (edited by Bahl, K. N.), 1931.
5	I	12	3	D	Baylis, H. A. & Daubney, R.	A SYNOPSIS OF THE FAMILIES & GENERA OF NEMATODA, The British Museum (Natural History), 1926.
6	I	37	5	F	Bernard, Henry M.	CATALOGUE OF THE MADREPORARIAN CORALS IN THE BRITISH MUSEUM (Natural History). The genus *Turbinaria*, the genus *Astraeopora*—Vol. II, 1896.
7	I	38	5	F	do.	do. the genus *Montipora*, the genus *Anacropora*—Vol. III, 1897. (for volume I *see* Brook, George).

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
8	I	36	5	F	Brook, George	CATALOGUE OF THE MADREPORARIAN CORALS in the British Museum (Natural History). The genus *Madrepora*, Vol. I. 1893. (For Vols. II & III *see* Bernard, Henry M.)
9	I	13	5	D	Clark, Hubert Lyman	A CATALOGUE OF THE RECENT SEA URCHINS (*Echinoidea*) in the collection of the British Museum (Natural History). 1925.
10	I	9	5	D	Colthurst, Ida	SHELLS OF THE TROPICAL SEAS, 1930.
11	I	10	5	D	do.	do.
12	I	42	5	E	Crouch, Edmund A.	AN ILLUSTRATED INTRODUCTION TO LAMARCK'S CONCHOLOGY, 1827.
					Daubney, R.	(*See* Baylis, H. A. & Daubney, R.)
13	I	30	5	D	Duncan, Winifred	WEBS IN THE WIND—the habits of web-weaving spiders, 1949.
14	I	32	5	D	Ellis, R. A.	SPIDER-LAND, 1912.
15	I	2	5	D	Fischer, Dr. Paul	MANUEL DE CONCHYLIOLOGIE et de Paleontologie conchyliologique ou Histoire Naturelle des Mollusques vivants et fossiles, 1887.
16	I	8	5	D	Hickson, Sydney J.	AN INTRODUCTION TO THE STUDY OF RECENT CORALS, 1924.
17	I	4	5	D	Hornell, James	THE SACRED CHANK OF INDIA. A Monograph on the Indian Conch (*Turbinella pyrum*), Madras Fisheries Bureau, Bulletin No. 7, 1914.
18	I	5	5	D	do.	THE COMMON MOLLUSCS OF SOUTH INDIA—Report No. 6 of 1921, Madras Fisheries Bulletin Vol. XIV, pages 97 to 215, 1922.
					Karandikar, K. R.	(*See* Subramanyam, T. V. Karandikar, K. R. & Murthi, N. N.)
19	I	18	5	D	Kennard, A. S. & Woodward, B. B.	SYNONYMY OF THE BRITISH NONMARINE MOLLUSCA—(Recent & post-tertiary), British Museum (Natural History), 1926.
20	I	3	5	D	Lang, William Dickson, Smith, Stanley & Thomas, Henry Dighton	INDEX PALAEOZOIC CORAL GENERA—British Museum (Natural History), 1940.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
21	I	19	5	D	Melvill, James Cosmo & Abercrombie, Alexander	THE MARINE MOLLUSCA OF BOMBAY. Reprinted from the Memoirs and proceedings of the Manchester Literary and Philosophical Society, Series 4, Vol. VII, 1893.
					Murthi, N. N.	(*See* Subrahmanyum, T. V. Karandikar, K. R. & Murthi, N. N.)
					Rai, H. S.	(*See* Awati, P. R. & Rai, H. S.)
22	I	20	5	D	Reeve, Lovell	THE LAND & FRESHWATER MOLLUSKS indigenous to or naturalised in the British Isles, 1863.
23	I	34	5	D	Robert, Paul A.	WONDERS OF THE SEA-SHELLS, 1945.
24	I	31	5	D	Savory, Theodore H.	THE BIOLOGY OF SPIDERS, 1928.
25	I	16	5	D	Shipley, Arthur E.	PEARLS AND PARASITES, 1908.
					Smith, Stanley	(*See* Lang, William Dickson, Smith, Stanley & Thomas, Henry Dighton).
26	I	21	5	D	Sowerby, J.	GENERA OF RECENT AND FOSSIL SHELLS, Vol. I, 1822—'34.
27	I	22	5	D	do.	do. Vol. II, 1822-'34.
28	I	23	5	D	do.	do. Vol. III, 1822-'34.
29	I	11	5	D	Subrahmanyam, T.V. Karandikar, K. R. & Murthi, N. N.	THE MARINE PELECYPODA OF BOMBAY. Reprinted from the Journal of the University of Bombay, Vol. XVII, Part 5, 1949.
30	I	26	5	D	Tate, Ralph	A PLAIN AND EASY ACCOUNT OF THE LAND AND FRESHWATER MOLLUSKS OF GREAT BRITAIN, 1866.
					Thomas, Henry Dighton	(*See* Lang, William Dickson, Smith, Stanley & Thomas, Henry Dighton).
31	I	41	5	D	Thorrel, T.	DESCRIPTIVE CATALOGUE OF THE SPIDERS OF BURMA based upon the collection made by Oates, Eugene W., 1895.
32	I	17	5	D	Various Authors	PAPERS ON LAND AND MARINE MOLLUSCA, a bound serial.
33	I	1	5	D	Verbeek, R. D. M.	RAPPORT SUR LES MOLUQUES. Edition francaise du Jaarbock Van het Mijnwezen in Nederlandsch Oost—Indië Tome, XXXVII, 1908.
34	I	25	5	D	Vertrees, Herbert H.	PEARLS & PEARLING 1913.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
35	I	33	5	D	Warburton, Cecil	Spiders, the Cambridge Manuals of Science and Literature, 1912.
36	I	14	5	D	Withers, Thomas Henry	Catalogue of Fossil Cirripedia in the Department of Geology, Vol. I—Triassic and Jurassic, British Museum (Natural History), 1928.
37	I	15	5	D	do.	Catalogue of The Machaeridia (Turrilepas and its allies) in the department of Geology, British Museum (Natural History) 1926.
38	I	40	5	F	do.	Catalogue of Fossil cirripedia in the department of Geology (Cretaceous), Vol. II, 1935.
39	I	24	5	D	Woodward, B. B.	The Life of the Mollusca, 1913.
40	I	27	5	D	Woodward, S. P.	A Manual of the Mollusca or Rudimentary treatise of recent and fossil shells, 1851-'56.
41	I	28	5	D	do.	do. 1880.
42	I	29	5	D	do.	do.
					Woodward, B. B.	(*See* Kennard, A. S. & Woodward, B. B.).

SUPPLEMENT TO PART V

I F R—*The Fauna of British India Series*; *Reference volume, not lent out.*

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
1	IFR	5	7	B	Annandale, N.	The Fauna of British India including Ceylon & Burma, Freshwater sponges, Hydroids & Polyzoa, 1911.
2	IFR	5b	7	B	do.	do.
3	IFR	10	7	B	Baylis, H. A.	do. Nematoda, (Ascaroidea & strongyloidea) Vol. 1, 1936.
4	IFR	11	7	B	do.	do. (Filarioidea, Dictophymoidea & Trichinelloidea) Vol. II, 1939.
5-6	IFR	12-13	7	B	do.	do. a duplicate set.
7	IFR	1	7	B	Bhatia, B. L.	The Fauna of British India including Ceylon & Burma, Protozoa : sporozoa, 1938.
8	IFR	2	7	B	do.	do.
9	IFR	3	7	B	do.	do. Protozoa : Ciliophora, 1936.
10	IFR	4	7	B	do.	do.
11	IFR	17	7	B	Blanford, Dr. W. T. & Godwin-Austin, Lt.-Col. H. H.	The Fauna of British India including Ceylon & Burma, Mollusca—Testacellidae & Zonitidae, 1908.
12	IFR	18	7	B	do.	do.
					Godwin-Austin, Lt.-Col. H. H.	*See* Blanford, Dr. W. T. & Godwin-Austin, Lt.-Col. H. H.
13	IFR	21	7	B	Gude, G. K.	The Fauna of British India including Ceylon & Burma, Mollusca (Trichomorphidae--Janellidae) Vol. II, 1914.
14	IFR	22	7	B	do.	do. Land Operculates (Cyclophoridae, Truncatellidae, Helicinidae) Vol. III, 1921.
15-16	IFR	23-24	7	B	do.	do. a duplicate set.
17	IFR	13	7	B	Harding, W. A. & Moore, Prof. J. Percy.	The Fauna of British India including Ceylon & Burma, Hirudinea, 1927.
18	IFR	14	7	B	do.	do.
					Moore, Prof. J. Percy	*See* Harding, W. A. & Moore, Prof. J. Percy.
19	IFR	25	7	B	Pocock, R. I.	The Fauna of British India including Ceylon and Burma, Arachnida, 1900.
20	IFR	26	7	B	do.	do.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
21	IFR	19	7	B	Preston, H. B.	The Fauna of British India including Ceylon & Burma, Mollusca (Fresh-water Gastropoda & Pelecypoda), 1915.
22	IFR	20	7	B	do.	do.
23	IFR	6	7	B	Southwell, T.	The Fauna of British India including Ceylon & Burma, Cestoda, Vol. I, 1930.
24	IFR	7	7	B	do.	do. Vol. II, 1930.
25-26	IFR	8-9	7	B	do.	do. a duplicate set.
27	IFR	15	7	B	Stephenson, J.	The Fauna of British India including Ceylon & Burma, Oligochaeta, 1923.
28	IFR	16	7	B	do.	do.

PART VI—BOTANY

B—Botany

B R—Botany—Reference volume, not lent out.

B F I R—The Flora of British India series. Reference volume, not lent out.

B F B R—The Flora of Bombay series. Reference volume, not lent out.

B F M R—The Flora of Madras series. Reference volume, not lent out.

B Ag.—Agriculture.

B S—Silviculture.

B P—Pharmacopia & Medicine.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
1	B	130	10	D	Aitchison, J. E. T.	ON THE FLORA OF THE KURAM VALLEY ETC., Afghanistan (Reprinted from the Journal of the Linnean Society), Vol. XVIII, 1880.
2	B	206	11	C	Allen, Grant	THE STORY OF THE PLANTS, 1895.
3	B	161	10	E	Alston, A. H. G.	THE KANDY FLORA, 1938.
4	B	154	10	E	Astbury, W. T.	TEXTILE FIBRES UNDER THE X-RAYS.
5	B R	216	25	A	Bailey, L. H.	THE STANDARD CYCLOPEDIA OF HORTICULTURE A—E, Vol. I, 1927.
6	B R	217	25	A	do.	do. F—O, Vol. II, 1927.
7	B R	218	25	A	do.	do. P—Z, Vol. III, 1927.
8	B	4	10	A	Baillon, H.	THE NATURAL HISTORY OF PLANTS — Ranunculaceae, Dilleniaceae, Magnoliaceae Anonaceae, Monimiaceae, Rosaceae, Vol. I, 1871.
9	B	5	10	A	do.	do. Connaraceae, Legumanoceae, Proteaceae, Lauraceae, Elaeagnaceae & Myristicaceae,—Vol. II, 1872.
10	B	6	10	A	do.	do. Menispermaceae, Berberidaceae, Nymphaceae, Papavaraceae, capparidaceae, Cruciferae, Resedaceae, Crassulaceae, Saxifragaceae, Piperaceae, Urticaceae, Vol. III, 1874.
11	B	7	10	A	do.	do. Nyctaginaceae, Phytolaccaceae, Malvaceae, Tiliaceae, Dipterocarpoceae, Chlaenaceae, Ternstroemiaceae, Binaceae, Cistaceae, Violaceae, Ochnaceae, Rutaceae, Vol. IV, 1875.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
12	B	8	10	A	Baillon, H.	do. Geraniaceae, Linaceae, Tremandraceae, Polygalaceae, Vochysiaceae, Euphorbiaceae, Terebinthaceae, Sapindaceae, Malpighiaceae, Meliaceae, Vol. V, 1878.
13	B	9	10	A	do.	do. Celastraceae, Rhamnaceae, Penaeaceae, Thymelaeaceae, Ulmaceae, Castaneaceae, Combretaceae, Rhizophoraceae, Myrtaceae, Hypericaceae, Clusiaceae, Lythrariaceae, Onagrariaceae, Balanophoraceae, Vol. VI, 1880.
14	B	10	10	A	do.	do. Melastomaceae, Cornaceae, Umbelliferae, Rubiaceae, Valerianaceae, Dipsacaceae, Vol. VII, 1881.
15	B Ag	249	25	B	Barron, Archibald F.	VINES & VINE CULTURE, Third Edition, 1892.
16	B R	21	10	A	Baynes, C. E.	ALBUM OF INDIAN FERNS, 1887.
17	B R	22	10	A	do.	do.
18	B Ag	188	11	C	Beccari, Dr. Odoardo	RELIQUIAE SCHEFFERIANAE, illustrazione di alcune Palmae Viventi nel Giardino Botanico di Buitenzorg, 1885.
19	B R	290	6	B	do.	ASIATIC PALMS—LEPIDOCARYEAE—THE SPECIES OF CALAMUS Part I, Annals of the Royal Botanic Gardens, Calcutta, Vol. XI, 1908.
20	B R	291	6	B	do.	do. Supplement, 1914.
21	B R	293	6	B	do.	do. Supplement Part I, Vol. XI, (Appendix), 1913.
22	B R	294	6	B	do.	do.
23	B R	295	6	B	do.	do. THE SPECIES OF DAEMONOROPS, Parts I-III (Text), Annals of the Royal Botanic Gardens, Calcutta, Vol. XII, 1911.
24	B R	296	6	B	do.	do. Plates.
25	B	135	10	D	Beddome, Col. R. H.	HANDBOOK TO THE FERNS OF BRITISH INDIA, Ceylon & Malay Peninsula, 1883.
26	B	140	10	D	do.	do.
27	B Ag	239	25	B	Beeton	BEETON'S ILLUSTRATED BOOK OF THE GARDEN—the theory and practice of garden in all its branches, 1889.
28	B	49	10	B	Benthall, A. P.	THE TREES OF CALCUTTA and its neighbourhood, 1946.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
29	B	95	10	C	Bibby, Cyril	SIMPLE EXPERIMENTS IN BIOLOGY, 1944.
30	B	167	10	E	Birdwood, George	CATALOGUE OF THE ECONOMIC PRODUCTS of the Presidency of Bombay—being a catalogue of the Government Central Museum, Division 1. –Raw – produce (vegetable), 1862.
31	B	168	10	E	do.	do.
32	B	139	10	D	Birdwood, G. C. M.	CATALOGUE OF THE VEGETABLE PRODUCTIONS OF THE PRESIDENCY OF BOMBAY; including a list of the drugs sold in the Bazaars of Western India, 2nd Edition 1865.
33	B	50	10	B	Birdwood, H. M.	A CATALOGUE OF THE FLORA of Matheran & Mahableshwar (Revised Edition), 1897.
34	B R	297	6	B	Biswas, Dr. K.	THE 150TH ANNIVERSARY VOLUME OF THE ROYAL BOTANIC GARDEN, CALCUTTA, PARTS I & II, 1942.
35	B S	252	25	B	Blake, Ernest G.	THE SEASONING & PRESERVATION OF TIMBER, being a treatise ON the various methods employed for drying and preserving timber against decay with a chapter on the origin and the spread of the dry rot and the best methods to be adopted for its eradication, 1924.
36	B	174	10	E	Blanchan, Neltje	WILD FLOWERS—The Nature Library, 1926.
37	B R	17	10	A	Blatter, The late Rev. E. & Millard, Walter S.	SOME BEAUTIFUL INDIAN TREES, 1937.
38	B	144	10	D	Blatter, Ethelbert	PLANT TYPES for College students, 1917.
39	B	89	10	C	Blatter, E. & D'Almeida, J. F.	THE FERNS OF BOMBAY, 1922.
40	B R	19	10	A	Blatter, Ethelbert	THE PALMS OF BRITISH INDIA & CEYLON, 1926.
41	B R	34	10	A	Blatter, S. J. Ethelbert	BEAUTIFUL FLOWERS OF KASHMIR, Vo. I, 1928.
42	B R	35	10	A	do.	do. Vol. II, 1928.
43	B	73	10	B	Blatter, E. McCann, C. & Sabnis, J. S.	THE FLORA OF THE INDUS DELTA, 1929.
44	B	148	10	E	Blatter, E. & McCann, C.	THE BOMBAY GRASSES—Scientific Monograph No. 5—The Imperial council of Agricultural Research, 1935.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
45	B R	47		Mus	Blatter, The late Rev. E. & Millard, Walter S.	SOME BEAUTIFUL INDIAN TREES, 1937.
46	B	105	10	C	Bose, Sir Jagdis Chunder	LIFE MOVEMENTS IN PLANTS—TRANSACTIONS OF the Bose Research Institute, Calcutta, Vol. I, pts. 1 & 2, 1918.
47	B	105a	10	C	do.	do. Vol. II, 1919.
48	B	122	10	D	Bower, F. O.	PLANTS & MAN—a series of essays relating to the Botany of ordinary life, 1925.
49	B	116	10	D	Brandis, Dietrich	INDIAN TREES—an account of trees, shrubs, woody climbers, Bamboo and Palms indigenous or commonly cultivated in the British Indian Empire, 1906.
50	B R	153	10	E	do.	ILLUSTRATIONS OF THE FOREST FLORA OF NORTHWEST AND CENTRAL INDIA, 1874.
51	B	131	10	D	Burkill, I. H.	A WORKING LIST OF THE FLOWERING PLANTS OF BALUCHISTAN, 1909.
52	B	169	10	E	Burns, W.	FIRMINGER'S MANUAL OF GARDENING FOR INDIA, 6th Edition (Revised & Edited), 1918.
					Caccia, A. M. F.	*See* D'Arcy, W. E. & Caccia, A. M. E.
53	B	114	10	D	Cain, Stanley A.	FOUNDATIONS OF PLANT GEOGRAPHY, 1944.
54	B A G	247	25	B	Cameron, J.	FIRMINGER'S MANUAL OF GARDENING FOR INDIA, 5th Edition, 1904.
55	B	132	10	D	Carey, M. C. & Fitchew, Dorothy	WILD FLOWERS AT A GLANCE, 1949.
56	B	155	10	E	Champion, H. G.	SILVICULTURAL MANUAL for use in India (The experimental manual), general Vol. I, 1931.
57	B	156	10	E	Champion, H. G. & Mahendru, I. D.	do. Statistical Research (the statistical code), Vol. II, 1931.
58	B R	15	10	A	Champion, H. G.	A PRELIMINARY SURVEY OF THE FOREST TYPES OF INDIA & BURMA—Indian Forest Records—(New Series) Silviculture, Vol. I, No. 1. 1936.
59	B	84	10	C	Cheeseman, T. F.	MANUAL OF THE NEW ZEALAND FLORA, 1906.
60	B	102	10	C	Cheyney, E. G.	WHAT TREE IS THAT? 1927.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
61	B R	287	6	B	Clarke, C. B.	Commelynaceae Et Cyrtandraceae Bengalenses (Paucis Aliis Ex Terris Adjacentibus Additis), 1874.
62	B	97	10	C	Cockayne, L.	New Zealand Plants and their story, 1910.
63	B Ag	203	11	C	Coit, J. Eliot	Citrus Fruits—an account of the citrus fruit industry with special reference to California requirements and practices and similar conditions, 1920.
64	B	87	10	C	Cole, Rex Vicat	The Artistic Anatomy of Trees—their structure and treatment in painting, 1925.
65	B	70	10	B	Collett, Col. Sir Henry	Flora Simlensis, a handbook of the flowering plants of Simla and neighbourhood, 1921.
66	B	74	10	B	Colthurst, Ida	Familiar Flowering Trees in India, 1924.
67	BFBR	36	10	B	Cooke, Theodore	The Flora of the Presidency of Bombay Vol. I, Part I (Ranunculaceae—Rutaceae), 1901.
68	BFBR	37	10	B	do.	do. Part II (Simarubaceae—Legumanoceae), 1902.
69	BFBR	38	10	B	do.	do. Part III (Legumanoceae contd.—Rubiaceae), 1903.
70	BFBR	39	10	B	do.	do. Vol. II, Part I (Compositeae — Boraginaccae), 1904.
71	BFBR	40	10	B	do.	do. Part II (Boraginaceae contd.–Verbenaceae), 1905.
72	BFBR	41	10	B	do.	do. Part III (Verbenaceae contd.—Euphorbiaceae), 1906.
73	BFBR	42	10	B	do.	do.-Part IV (Euphorbiaceae contd.—Araceae), 1907.
74	BFBR	43	10	B	do.	do. Part V, (Araceae contd. —Graminae with Index, 1908.
75	BFBR	44	Mus	B	do.	do. Vol. I (Ranunculaceae —Rubiaceae), 1901-1903. (in a single volume).
76	BFBR	45		Mus	do.	do. Vol. II (Compositeae—Graminae), 1904-1907. (in a single volume).
77	B Ag	244	25	B	Corrie, Frank Ewart	Manures & Manuring—a handbook for practical farmers, students and others, 1927.
78	B Ag	273	25	C	do.	Lime in Agriculture—a handbook for practical farmers, students and others, 1926.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
79	B R	46		Mus	Cowen, D. V.	FLOWERING TREES & SHRUBS IN INDIA, 1950.
80	B R	14	10	A	Curtis, Chartes H.	ORCHIDS for Everyone, 1910.
81	B Ag	89	11	C	Duthie, J. F.	THE FODDER GRASSES OF NORTHERN INDIA, 1888.
82	B	96	10	C	Daglish, E. Fitch	MARVELS OF PLANT LIFE, 1924.
					D'Almeida, J. F.	*See* Blatter, E. & D'Almedia, J. F.
83	B	92	10	C	Dalgado, Dr. D. G.	FLORA DE GOA E SAVANTVADI, 1898.
84	B S	183	11	C	D'Arcy, W. E. & Cacia, A. M. F.	PREPARATION OF FOREST WORKING-PLANS IN INDIA, 4th Edition, 1910.
85	B	65	10	B	Dalzell, Nicholas A. & Gibson, Alexander	THE BOMBAY FLORA or SHORT DESCRIPTIONS of all the indigenous plants hitherto discovered in or near the Bombay Presidency together with a supplement of introduced and naturalized species, 1861.
86	B	66	10	B	do.	do.
87	B	133	10	D	Darwin, Charles	THE VARIATION OF ANIMAL S & PLANTS under domestication, Vol. II, 1868.
88	B	142	10	D	do.	THE VARIOUS CONTRIVANCES BY WHICH ORCHIDS ARE FERTILIZED BY INSECTS, 2nd Edition, 1885.
89	B Ag	191	11	C	Davis, R. A.	CITRUS GROWING IN SOUTH AFRICA, 1924.
90	B Ag	248	25	C	Davis, Kary C.	HORTICULTURE ENTERPRISES, 1929.
91	B	196	11	C	Detmer, Dr. W.	LEHRBUCH DER PFLSNZENPHYSIOLOGIE, 1883.
92	B P	106	10	C	Dhargalker, Lakshman B.	NOTES ON THE THERAPEUTICS O F INDIGENOUS VEGETABLE DRUGS, 1st Edition, 1899.
93	B	104	10	C	Drury Maj. Heber	THE USEFUL PLANTS O INDIA alphabetically arranged with botanical descriptions, vernacular synonyms and notices of their economical value in commerce, medicine and the Arts, 1858.
94	B R	30	10	A	Duthie, J. F.	ILLUSTRATIONS OF THE INDIGENOUS FODDER GRASSES of the plains of North-western India, 1886.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
95	B Ag	180	11	C	Duthie, J. F. & Fuller, J. B.	FIELD AND GARDEN CROPS OF NORTH-WESTERN PROVINCES & OUDH, with illustrations—Department of Agriculture & Commerce—N.W. Provinces & Oudh, Part I, 1882.
					Duthie, J. F.	*See* Strachey, Lt.-Genl. Sir Richard & Duthie, J. F.
96	B P	275	11	C	Dymock, William Warden, C.J.H. & Hooper, David	PHARMACOGRAPHIA INDICA—a history of the principal drugs of vegetable origin met with in British India, Vol. I, 1890.
97	B P	276	11	C	do.	do. Vol. II, 1891.
98	B P	277	11	C	do.	do. Vol. III, 1892.
99	B Ag	269	25	C	Eisen, Gustav	THE FIG: its history, culture and curing with a descriptive catalogue of the known varieties of figs—U.S. Department of Agriculture Bulletin No. 9, 1901.
100	B Ag	270	25	C	Eisen, Gustav	do.
101	B	20	10	A	Exell, Arthur Wallis	CATALOGUE OF THE VASCULAR PLANTS OF S. TOME' (with principe and annobon) British Museum (Natural History), 1944.
102	B	125	10	D	Fawcett, W.	THE BANANA—its cultivation, distribution and commercial uses, 2nd Edition (enlarged), 1921.
103	B	101	10	C	Firminger, Thomas A. C.	A MANUAL OF GARDENING FOR BENGAL & Upper India, 3rd Edition, 1824.
					Fitchew, Dorothy	*See* Carey, M. C. & Fitchew, Dorothy.
104	B	141	10	D	Fletcher, S. W.	STRAW-BERRY GROWING, the rural science series (edited by Bailey, L. H.), 1917.
105	B	231	25	B	Freeman-Mitford, A. B.	THE BAMBOO GARDEN, 1896.
					Fuller, J. B.	*See* Duthie, J. F. & Fuller, J. B.
106	B	115	10	D	Gamble, J. S.	A MANUAL OF INDIAN TIMBERS—an account of the structure, growth distribution and quantities of Indian woods, 1881.
107	BFMR	61	10	B	do.	FLORA OF THE PRESIDENCY OF MADRAS, Vol. I, 1915
108	BFMR	62	10	B	do.	do. Vol. II, 1923.
109	BFMR	63	10	B	do.	do. Vol. III, 1931.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
110	B R	145	10	E	'Garden, The'	HORTICULTURAL ILLUSTRATIONS, Vol. I, 1890-1899.
111	B R	146	10	E	do.	do. Vol. II, do.
112	B R	147	10	E	do.	do. Vol. III, do.
113	B	194	11	C	Giboin, Lucien M.	EPITOME' DE BOTANIQUE ET DE MATIÉRE Médicale de L'inde et spécialement Des Establishment Francais Dans L'inde—Thése, 1949.
114	B	195	11	C	do.	do.
115	B	113	10	D	Good, Ronald	THE GEOGRAPHY OF THE FLOWERING PLANTS, 1947.
116	B Ag	240	25	B	Gould, H. P.	PEACH-GROWING, 1918.
117	B	64	10	B	Grant, Capt. Bartle	THE ORCHIDS OF BURMA (including Andaman Islands) Described, 1895.
118	B	94	10	C	Greaves, Joseph E. & Greaves, Ethelyn O.	BACTERIA IN RELATION TO SOIL FERTILITY, 1926.
119	B	157	10	E	Government Publication	A MANUAL OF FOREST LAW.—compiled for the use of the students at the Imperial Forest College, Dehra Dun, 1906.
120	B S	190	11	C	Government of India	A CONCISE MANUAL OF SYLVICULTURE for the use of the Forestry students in India, 1906.
121	B	201	11	C	Government of India	AGRICULTURE IN INDIA—The Publications division, Ministry of Information & Broadcasting Government of India, Delhi, 1950.
122	B	90	10	C	Graham, John	A CATALOGUE OF THE PLANTS GROWING IN BOMBAY AND ITS VICINITY; spontaneous, cultivated or introduced, as far as they have been ascertained, 1839.
123	B R	278	6	A	Griffith, William & M'Clelland, John	PALMS OF BRITISH EAST INDIA, 1850.
					Greaves, Ethelyn O.	*See* Greaves, Joseph E. & Greaves, Ethelyn O.
124	B	205	11	C	Haines, H. H.	A FOREST FLORA OF CHOTA NAGPUR including Gangpur and the Santalparganahs—a description of all the indigenous trees, shrubs and climbers, the principal economic herbs and the most commonly cultivated trees and shrubs, 1910.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
125	B	207	11	C	Haines, H. H.	DESCRIPTIVE LIST OF TREES, SHRUBS AND ECONOMIC HERBS of the Southern Circle, Central Provinces, 1916.
126	B	86	10	C	Harler, Agnes W.	THE GARDEN IN THE PLAINS, 3rd Edition, 1948.
					Haskell, Sidney B.	*See* Voorhees, Edward B. & Haskell, Sidney B.
127	B Ag	238	25	B	Head, Brandon	THE FOOD OF THE GODS, a popular account of Cocoa, 1903.
128	B Ag	233	25	B	Hedrick, U. P.	MANUAL OF AMERICAN GRAPE-GROWING, 1919.
129	B	72	10	B	Heinig, R. L.	GLOSSARY OF THE BOTANIC TERMS USED IN DESCRIBING FLOWERING PLANTS, 1899.
130	B	138	10	D	Hibberd, Shirley	THE AMATEUR'S KITCHEN GARDEN—a handy guide to the formation and management of the kitchen garden and the cultivation of useful vegetables and fruits.
					Hibberd, Shirley	*See* Hulme, F. Edward & Hibberd, Shirley
131	B	229	25	B	do.	NEW & RARE BEAUTIFUL LEAVED PLANTS; containing illustrations and descriptions of the most ornamental-foliaged Plants, 1870.
					Hillhouse, W.	*See* Strasburger, Dr. E. & Hillhouse, W.
132	B	120	10	D	Hole, R. S.	A MANUAL OF BOTANY FOR INDIAN STUDENTS, 1909.
					Holland, John Henry	*See* Nicholls, Sir Henry Alford & Holland, John Henry.
133	BFIR	52	10	B	Hooker, Sir J. D.	THE FLORA OF BRITISH INDIA, Vol. I (Ranunculaceae—sapindaceae), 1872.
134	BFIR	53	10	B	do.	do. Vol. II (Sabiaceae-Cornaceae), 1882.
135	BFIR	54	10	B	do.	do. Vol. III (Caprifoliaceae-Apocynaceae), 1879.
136	BFIR	55	10	B	do.	do. Vol. IV (Asclepediaceae—Amarantaceae), 1885.
137	BFIR	56	10	B	Hooker, Sir J. D.	THE FLORA OF BRITISH INDIA, Vol. V (Chenopodiaceae — Orchideae), 1890.
138	BFIR	57	10	B	do.	do. Vol. VI (Orchideae contd.—cyperaceae), 1894.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
139	BFIR	58	10	B	Hooker, J. D.	THE FLORA OF BRITISH INDIA, (Cyperaceae contd., Gramineae & General Index), 1897.
140	B R	286	6	B	do.	ILLUSTRATIONS OF HIMALAYAN PLANTS, 1855.
					Hooper, David	*See* Dymock, William Warden C. J. H. & Hooper, David
141	B	119	10	D	Howard, Albert & Howard, Gabrielle L. C,	WHEAT IN INDIA—its production, varieties and improvement, 1909.
					Howard, Gabrielle L. C.	*See* Howard, Albert & Howard, Gabrielle L. C.
142	B	124	10	D	Hughes-Gibb, Eleanor	TREES AND MEN, 1938.
143	B	261	25	B	Hulme, F. Edward & Hibberd, Shirley	FAMILIAR GARDEN FLOWERS —first series.
144	B	262	25	B	do.	do. second series.
145	B	263	25	B	do.	do. third series.
146	B	264	25	B	do.	do. fourth series.
147	B	265	25	B	do.	do. fifth series.
148	B	255	25	B	Hulme, F. Edward	Familiar Wild Folwers—first series.
149	B	256	25	B	do.	do. second series.
150	B	257	25	B	do.	do. third series.
151	B	258	25	B	do.	do. fourth series.
152	B	259	25	B	do.	do. fifth series.
153	B	260	25	B	do.	do. sixth series.
154	B	59	10	B	Hutchinson, J.	THE FAMILIES OF FLOWERING PLANTS I Dicotyledons, 1926.
155	B	60	10	B	do.	do. II Monocotyledons, 1934.
156	B	158	10	E	Jacquot, A.	INCENDIES EN FORÊT (Forest Fires) (Translated by Fisher, C. E. C.), 1910.
157	B	165	10	E	Jekyll, Gertrude	WOOD & GARDEN—notes and thoughts, practical and critical of a working amateur, 1899.
158	B	159	10	E	Kapur, S. N.	A MANUAL OF THE AIR SEASONING OF INDIAN TIMBERS, 1934.
159	B	88	10	C	Keeble, Sir Frederick	LIFE OF PLANTS, 1926.
160	B P	200	11	C	Khory, Rustomjee Naserwanjee	THE BOMBAY MATERIA MEDICA & THEIR THERAPEUTICS, 1887.
161	B R	289	6	B	King, George	THE SPECIES OF MYRISTICA OF BRITISH INDIA, Annals of the Royal Botanic Gardens, Calcutta Vol. III (pt. 4), 1891.
162	B Ag	246	25	B	King, F. H.	IRRIGATION & DRAINAGE—principles and practice of their cultural phase. 8th Edition, 1922.

Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
163	B	121	10	D	Kirk, Thomas	THE STUDENTS' FLORA OF NEW ZEALAND, 1899.
164	B	112	10	D	Klages, Karl H. W.	ECOLOGICAL CROP GEOGRAPHY, 1942.
165	B	150	10	E	Kurz, Sulpice	PRELIMINARY REPORT ON THE FOREST & OTHER VEGETATION OF PEGU, 1875.
166	B Ag	237	25	B	Landolicus	THE INDIAN AMATEUR GARDENER, practical hints on the cultivation of garden flowers and important vegetable seeds adapted for the plains of Bengal, the North-west Provinces and hill-stations, 3rd Edition, 1902.
167	B	192	11	C	Lanjouw, J.	SYNOPSIS OF PROPOSALS concerning the international rules of Botanical nomenclature submitted to the seventh International Botanical Congress—Stockholm, 1950.
168	B	18	10	A	Lisboa, J. C.	LIST OF BOMBAY GRASSES & THEIR USES, 1896.
169	B	176	10	E	do.	USEFUL PLANTS of the Bombay Presidency, 1886.
170	B	198	11	C	Lister, Arthur & Lister, Gulielma	A MONOGRAPH OF THE MYCETOZOA—a descriptive catalogue of the species in the Herbarium of the British Museum, 2nd Edition, Revised, 1911.
					Lister, Gulielma	*See* Lister, Arthur & Lister, Gulielma.
171	B	182	11	C	Lloyd, C. G.	INDEX OF THE MYCOLOGICAL WRITINGS Vol. VI, 1920-1921.
172	B	171	10	E	Lowe, E. J. & Howard, W.	BEAUTIFUL LEAVED PLANTS; being a description of the most beautiful plants in cultivation in this country, 1845.
173	B R	27	10	A	Lowis, Lena	FAMILIAR INDIAN FLOWERS with coloured plates, 1878.
174	B R	28	10	A	do.	do.
175	B R	29	10	A	do.	do.
176	B Ag	236	25	B	Lyon, T. Lyttleton	SOILS & FERTILIZERS—Rural Text-book series, 1926.
177	B	68	10	B	Macmillan, H. F.	TROPICAL GARDENING AND PLANTING with special reference to Ceylon, 1925.
178	B	69	10	B	do.	do.
179	B	103	10	C	Madison, Harold L.	WILD FLOWERS OF OHIO, 1938.

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					Mahendru, I. D.	*See* Champion, H. G. & Mahendru, I. D.
180	B	23	10	A	Maiden, J. H.	THE FOREST FLORA OF NEW SOUTH WALES Vol. I (parts 1-10), 1904.
181	B	24	10	A	do.	do. Vol. II (parts 11-20), 1907.
182	B	25	10	A	do.	do. Vol. III (parts 21-30), 1908.
183	B	26	10	A	do.	do. Vol. IV (parts 31-40), 1908.
184	B	85	10	C	Maiden, J. H.	THE USEFUL NATIVE PLANTS OF AUSTRALIA (including Tasmania), 1889.
185	B	48	10	B	McCann, Charles	TREES OF INDIA—a popular Handbook, 1947.
					do.	*See* Blatter, E. & McCann, C.
					do.	*See* Blatter, E., McCann, C. & Sabnis, T. S.
186	B	175	10	E	McCurdy, Robert M.	GARDEN FLOWERS, The Nature Library, 1926.
187	B	107	10	C	McDonald, Donald	ENGLISH VEGETABLES & FLOWERS IN INDIA & CEYLON, 2nd Edition, 1890.
					M'clelland, John	*See* Griffith, William & M'clelland, John.
					Millard, Walter S.	*See* Blatter, the late Rev. E. & Millard, Walter S.
					do.	*See* Blatter, the late Rev. E. & Millard, Walter S.
188	B Ag	184	11	C	Mollison, J.	A TEXT-BOOK ON INDIAN AGRICULTURE—SOILS, MANURES, IMPLEMENTS, 1901.
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194	B	160	10	E	Murray, James A.	THE PLANTS AND DRUGS OF SIND; being a systematic account, with descriptions of the indigenous Flora and notices of the value and uses of their products in commerce, medicine and the arts, 1881.

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195	B P	254	25	B	Nadkarni, K. M.	Indian Plants & Drugs with their medical properties and uses, 1908.
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202	B	126	10	D	Pfleiderer, I.	Glimpses into the Life of Indian Plants—an elementary Indian Botany, 1908.
203	B	127	10	D	do.	do. 4th Edition, 1921.
204	B	164	10	E	Pierce, Newton B.	Peach Leaf curl, Its nature and treatment—U.S. Department of Agriculture, Bulletin No. 20, 1900.
205	B R	283	6	A	Pierce, L.	Flore Forestiére de la cochinchine.
206	B Ag	271	25	C	Popenoe, Wilson	Manual of Tropical & Subtropical fruits, excluding the banana, cocoanut, pineapple, citrus fruits, olive and fig, 1927.
207	B R	288	6	B	Prain, David	The Species of *Pedicularis* of the Indian Empire & its Frontiers, Parts I-III, Annals of the Royal Botanic Gardens, Calcutta, Vol. III, 1890.
208	B	123	10	D	do.	Botanical Notes & Papers, 1901.
209	B Ag	250	25	B	Quinn, George	Fruit Trees & Grape vine pruning—a handbook for fruit and vine growers, 6th Edition, 1921.
210	B	245	25	B	Reeves, J. A.	Sap—Does it rise from the roots? Experiments and observations on trees and other plants, 1890.

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211	B S	193	11	C	Ribbentrop, B.	Forestry in British India, 1900.
212	B	75	10	C	Ridley, Henry N.	The Flora of the Malay Peninsula — Polypetalae, Vol. I, 1922.
213	B	76	10	C	do.	do. -Gamopetalae, Vol. II, 1923.
214	B	77	10	C	do.	do.-Apetalae, Vol. III, 1924.
215	B	78	10	C	do.	do. -Monocotyledones, Vol. IV, 1924.
216	B	79	10	C	do.	do. -Monocotyledones (concluded) Gymnospermeae, General Indices, Vol. V, 1925.
217	B	118	10	D	do.	The Dispersal of Plants throughout the world, 1930.
218	B R	32	10	A	Robert, Paul A. & Schroeter, Prof. Dr. Carl	Alpine Flowers, Iris Books, 1945.
219	B	128	10	D	Robinson, W.	The English Flower Garden & Home grounds, 8th Edition, 1902.
220	B	173	10	E	Rogers, Julia Ellen	Trees—The Nature Library, 1926.
221	B	108	10	C	Royal Botanic Gardens, Kew.	Orchids—Collection of picture post cards of various Orchids.
222	B R	33	10	A	Royle, J. Forbes	Illustrations of the Botany & other Branches of the Natural History of the Himalayan Mountains and of the Flora of Cashmere, 1839.
223	B	274	25	C	do.	The Fibrous Plants of India fitted for cordage, clothing and paper, 1855.
224	B	16	10	A	Roxburgh, William	Flora Indica or Descriptions of Indian Plants, 1874.
225	B	129	10	D	do.	do.
					Sabnis, T. S.	*See* Blatter, E., McCann, C, & Sabnis, T. S.
226	B	162	10	E	Sahasrabuddhe, Rao Bahadur D. L.	Experiments in manuring crops in the Bombay Presidency 1896-1931, First Edition, 1934.
227	B R	279	6	A	Sander, F.	Reichenbachia—Orchids illustrated and described, Vol. I, 1888.
228	B R	280	6	A	do.	do. Vol. II, 1890.
229	B R	284	6	A	do.	Reichenbachia—Orchids illustrated and described, Vol. I (second series), 1892.
230	B R	285	6	A	do.	do. 1894.

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231	B	199	11	C	Sawer, J. Ch.	ODOROGRAPHIA—a Natural History of raw materials and drugs used in the perfume industry including the aromatics used in flavouring, 1894.
232	B	109	10	C	Seemann, Berthold	POPULAR HISTORY OF THE PALMS AND THEIR ALLIES, 1856.
233	B	208	11	C	Simari, R. F.	OLIVICOLTURA ED OLEIFICIO MODERNO, MANUALI HOEPLI, second edizione, 1923.
					Sloane, Boyd L.	*See* White Alain & Sloane, Boyd L.
234	B	143	10	D	Smythies, E. A.	INDIA'S FOREST WEALTH, 2nd Edition, 1925.
235	B Ag	235	25	B	Snyder, Harry	SOILS & FERTILIZERS, 3rd Edition, 1918.
236	B	71	10	B	Stevens, T. H. G.	TREE & SHRUBS IN MY GARDEN, 1938.
237	B	134	10	D	Strachey, Lt.-Genl. Sir Richard & Duthie, J. F.	CATALOGUE OF THE PLANTS OF KUMAON and of the adjacent portions of Garhwal and Tibet, 1906.
238	B	111	10	D	Strasburger, Dr. E. & Hillhouse, W.	HANDBOOK OF PRACTICAL BOTANY for the botanical laboratory and private student, 7th Edition, Revised, 1911.
239	B	166	10	E	Sweet, Robert	SWEET'S HORTUS BRITANNICUS, or A catalogue of all the plants indigenous or cultivated, in the gardens of Great Britain, arranged according to the Natural system, 3rd Edition, 1839.
240	B	51	10	B	Talbot, W. A.	SYSTEMATIC LIST OF THE TREES, SHRUBS AND WOODY-CLIMBERS OF BOMBAY PRESIDENCY, 1894.
241	B R	151	10	E	do.	FOREST FLORA OF THE BOMBAY PRESIDENCY & SIND, (Ranunculaceae to Rosaceae) Vol. I, 1909.
242	B R	152	10	E	do.	do. (Rhizophoraceae to Gramineae) Vol. II, 1911.
243	B	137	10	D	Taylor, J. E.	THE SAGACITY & MORALITY OF PLANTS, 1884.
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246	B R	172	10	E	Tournefort	THE COMPLEAT HERBAL, 1716.
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249	B	80	10	C	do.	A HAND-BOOK TO THE FLORA OF CEYLON containing descriptions of all the species of flowering plants indigenous to the Island and notes on their history, distribution and uses—Ranunculaceae — Anacardiaceae—Part I, 1893.
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261	B	110	10	D	Vines, Sydney H.	A STUDENT'S TEXT-BOOK OF BOTANY, 1910.

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262	B Ag	242	25	B	Voorhees, Edward B. & Haskell, Sidney B.	FERTILIZERS—the source, character and composition of fertilizer materials and suggestions as to their use, 1926.
263	B R	281	6	A	Wallich, Nathaniel	PLANTAE ASIATICAE RARIORES or Descriptions and figures of a select number of unpublished East Indian plants, Vol. I-II Text, 1830.
264	B R	282	6	A	do.	do.-Plates, 1832.
					Warden, C. J. H.	*See* Dymock, William Warden, C. J. H. & Hooper, David
265	B Ag	243	25	B	Watson, W.	CACTUS CULTURE FOR AMATEURS: being descriptions of the various cactuses grown in this country with full and practical instructions for their successful cultivation, 1889.
266	B R	219	25	A	Watt, Sir George	THE COMMERCIAL PRODUCTS OF INDIA—being an abridgment of 'The Dictionary of the Economic Products of India', 1908.
267	B R	220	25	A	Watt, George	A DICTIONARY OF THE ECONOMIC PRODUCTS OF INDIA, cabbage to cyperus, Vol. II, 1889.
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274	B R	227	25	A	do.	do. Tectona to Zygophillum, Part IV Vol. VI, 1893.
275	B R	228	25	A	do.	do. Index, 1896.
276	B Ag	234	25	B	Wheeler, Homer J.	MANURES & FERTILIZERS—Rural Textbook series, 1924.
277	B	163	10	E	White, Alain & Sloane, Boyd L.	THE STAPELIEAE—an introduction to the study of this tribe of Asclepiadaceae, 1933.
278	B	1	10	A	do.	THE STAPELIEAE, Vol. I, 2nd Edition, 1937.

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Serial No.	Classification	Accession No.	Cabinet	Shelf	Author	Title of Book
279	B	2	10	A	Sloane, Boyd L.	THE STAPELIEAE Vol. II.
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281	B Ag	170	10	E	Wickson, Edward J.	THE CALIFORNIA FRUITS and how to grow them, 3rd Edition, 1900.
282	B Ag	267	25	C	do.	do. 9th Edition, 1921.
283	B Ag	241	25	B	Widtsoe, John A.	THE PRINCIPLES OF IRRIGATION PRACTICE, 1926.
284	B R	209	25	A	Wight, Robert	ILLUSTRATIONS OF INDIAN BOTANY or figures illustrative of each of the Natural Orders of Indian plants, described in the author's Prodromus Florae Peninsulae Indiae Orientalis, 1840.
285	B R	210	25	A	do.	do.
286	B R	211	25	A	do.	ICONES PLANTARUM INDIAE ORIENTALIS or Figures of Indian Plants, plates 319-736, Vol. II, 1843.
287	B R	212	25	A	do.	do. Plates 737-1163, Vol. III, 1845.
288	B R	213	25	A	Wight, Robert	do. Plates 1164-1621, Vol. IV, 1850.
289	B R	214	25	A	do.	do. Plates 1622-1920, Vol. V, 1852.
290	B R	215	25	A	do.	do. Plates 1921-2101, Vol. VI, 1853.
291	B Ag	235	25	B	Wilcox, Earley Vernon	TROPICAL AGRICULTURE, 1929.
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297	B	100	10	C	do.	GARDENING IN THE TROPICS being a seventh edition of '*Gardening in India*' adapted for tropical or semitropical regions.

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